

Fishery Management Report No. 98-2

Area Management Report for North Gulf of Alaska Recreational Groundfish Fisheries, 1997

by

Doug Vincent-Lang

July 1998

Alaska Department of Fish and Game

Division of Sport Fish



Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition. All others must be defined in the text at first mention, as well as in the titles or footnotes of tables and in figures or figure captions.

Weights and measures (metric)		General		Mathematics, statistics, fisheries	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	H_A
deciliter	dL			base of natural logarithm	e
gram	g	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	catch per unit effort	CPUE
hectare	ha	and	&	coefficient of variation	CV
kilogram	kg	at	@	common test statistics	F, t, χ^2 , etc.
kilometer	km	Compass directions:		confidence interval	C.I.
liter	L			correlation coefficient	R (multiple)
meter	m	east	E	correlation coefficient	r (simple)
metric ton	mt	north	N	covariance	cov
milliliter	ml	south	S	degree (angular or temperature)	°
millimeter	mm	west	W	degrees of freedom	df
		Copyright	©	divided by	÷ or / (in equations)
		Corporate suffixes:			
		Company	Co.	equals	=
		Corporation	Corp.	expected value	E
		Incorporated	Inc.	fork length	FL
		Limited	Ltd.	greater than	>
		et alii (and other people)	et al.	greater than or equal to	≥
		et cetera (and so forth)	etc.	harvest per unit effort	HPUE
		exempli gratia (for example)	e.g.,	less than	<
		id est (that is)	i.e.,	less than or equal to	≤
		latitude or longitude	lat. or long.	logarithm (natural)	ln
		monetary symbols (U.S.)	\$, ¢	logarithm (base 10)	log
		months (tables and figures): first three letters	Jan,...,Dec	logarithm (specify base)	log ₂ , etc.
		number (before a number)	# (e.g., #10)	mid-eye-to-fork	MEF
		pounds (after a number)	# (e.g., 10#)	minute (angular)	'
		registered trademark	®	multiplied by	x
		trademark	™	not significant	NS
		United States (adjective)	U.S.	null hypothesis	H_0
		United States of America (noun)	USA	percent	%
		U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	probability	P
				probability of a type I error (rejection of the null hypothesis when true)	α
				probability of a type II error (acceptance of the null hypothesis when false)	β
				second (angular)	"
				standard deviation	SD
				standard error	SE
				standard length	SL
				total length	TL
				variance	Var
Weights and measures (English)					
cubic feet per second	ft ³ /s				
foot	ft				
gallon	gal				
inch	in				
mile	mi				
ounce	oz				
pound	lb				
quart	qt				
yard	yd				
Spell out acre and ton.					
Time and temperature					
day	d				
degrees Celsius	°C				
degrees Fahrenheit	°F				
hour (spell out for 24-hour clock)	h				
minute	min				
second	s				
Spell out year, month, and week.					
Physics and chemistry					
all atomic symbols					
alternating current	AC				
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

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**AREA MANAGEMENT REPORT FOR NORTH GULF OF ALASKA
RECREATIONAL GROUND FISH FISHERIES, 1997**

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July 1998

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TABLE OF CONTENTS

	Page
LIST OF TABLES.....	iii
LIST OF FIGURES	iv
SECTION I: OVERVIEW.....	1
Management Arena.....	1
Fisheries Overview	1
Angling Effort.....	3
Economic Value.....	6
Management Authorities.....	7
Fishery Objectives	7
Fishery Evaluation Program	8
Major Issues.....	8
Halibut	8
Lingcod.....	9
Rockfish.....	10
Salmon Sharks	11
Guide Licensing.....	11
SECTION II: FISHERIES.....	13
North Gulf of Alaska Recreational Halibut Fishery.....	13
Management Objective and Approach.....	15
Stock Status.....	15
Fishery Overview.....	15
Regulatory Area 3A.....	15
Cook Inlet.....	19
Kodiak.....	23
North Gulf Coast.....	23
Prince William Sound	30
Regulatory Area 3B.....	30
Regulatory Area 4	30
Management Issues	32
Management History.....	34
Ongoing Research and Management Activities	34
North Gulf of Alaska Recreational Rockfish Fisheries.....	34
Management Objective and Approach.....	36
Stock Status.....	37
Fisheries Overview	37
Management Issues.....	37
Management History.....	42
Ongoing Research and Management Activities	43
North Gulf of Alaska Recreational Lingcod Fishery	44
Management Objective and Approach.....	45
Stock Status.....	47
Fishery Overview.....	47
Management Issues.....	49
Management History.....	49
Ongoing Research and Management Activities	51

TABLE OF CONTENTS (Continued)

	Page
North Gulf of Alaska Recreational Salmon Shark Fishery	52
Management Objective and Approach.....	53
Stock Status.....	53
Fishery Overview	53
Management Issues	54
Management History	54
Ongoing Research and Management Activities	55
LITERATURE CITED.....	55

LIST OF TABLES

Table	Page
1. Number of angler-days expended by recreational anglers fishing for halibut, rockfish, and lingcod in the North Gulf of Alaska, 1987-1996.	4
2. Number of companies and employed guides that registered with the department to provide sport fishing guide services in marine waters of the North Gulf of Alaska during 1995 and 1996.	6
3. User group composition of the recreational fleet targeting groundfish at select North Gulf of Alaska ports, 1996.	6
4. Number of angler-days expended by recreational anglers fishing for halibut in the North Gulf of Alaska, 1987-1996.	16
5. Number of halibut harvested by recreational anglers fishing in IPHC Regulatory Area 3A, 1977-1996.	17
6. Number of pounds of halibut harvested by recreational anglers fishing in IPHC Regulatory Area 3A, 1977-1996.	19
7. Estimated halibut catch, harvest, and percent of catch released in the Area 3A recreational fishery, 1990-1996.	21
8. Number of halibut harvested in Cook Inlet recreational fisheries, 1977-1996.	25
9. Species comprising the slope, pelagic shelf, and demersal shelf rockfish assemblages.	35
10. Harvest of rockfish, by area, by recreational anglers fishing North Gulf of Alaska waters, 1977-1996.	38
11. Number of rockfish released, by area, by recreational anglers fishing North Gulf of Alaska waters, 1990-1996.	39
12. Comparison of recreational and commercial harvests of rockfish (pounds, round weight) in the North Gulf of Alaska, 1991-1996.	40
13. Harvest of lingcod, by area, by recreational anglers fishing North Gulf of Alaska waters, 1987-1996.	45
14. Commercial harvest (pounds, round weight) of lingcod, by area, along the North Gulf of Alaska, 1987-1996.	46
15. Comparison of recreational and commercial harvests of lingcod from North Gulf of Alaska waters, 1991-1996.	47
16. Percent of lingcod catch, by area, that was released by recreational anglers fishing North Gulf of Alaska waters, 1991-1996.	48

LIST OF FIGURES

Figure	Page
1. Area of management responsibility for marine groundfishes in the North Gulf of Alaska.....	2
2. Number of angler-days expended by recreational anglers fishing for halibut, rockfish, and lingcod in the North Gulf of Alaska, 1987-1996.....	5
3. Regulatory areas established by the International Pacific Halibut Commission to manage North Pacific halibut stocks.....	14
4. Number of angler-days expended by recreational anglers fishing for halibut in IPHC Regulatory Area 3A, 1987-1996.....	16
5. Number of halibut harvested by recreational anglers fishing for halibut in IPHC Regulatory Area 3A, 1977-1996.....	18
6. Number and pounds of halibut harvested by recreational anglers fishing for halibut in IPHC Regulatory Area 3A, 1977-1996.....	20
7. Observed and projected growth in halibut harvests by recreational anglers (chartered and nonchartered) in IPHC Regulatory Area 3A through the year 2000.....	22
8. Removals of halibut in IPHC Regulatory Area 3A during 1996.....	23
9. North Gulf of Alaska coastal waters and major ports of recreational halibut landings in IPHC Regulatory Area 3A.....	24
10. Percentage of the total recreational halibut harvests by chartered anglers in Kenai Peninsula fisheries, 1986-1996.....	26
11. Approximate areas fished in the Central and Lower Cook Inlet recreational halibut fisheries.....	27
12. Approximate waters fished by the Kodiak-based recreational halibut fleet.....	28
13. Approximate waters fished along the North Gulf Coast by the Seward-based recreational halibut fleet.....	29
14. Waters fished by recreational halibut fleets based out of Whittier, Valdez, and Cordova.....	31
15. Harvests of rockfish by recreational anglers fishing North Gulf of Alaska waters, 1977-1996.....	39
16. Number of rockfish released by recreational anglers fishing North Gulf of Alaska waters, 1990-1996.....	40
17. Harvest of lingcod by recreational anglers fishing Seward area waters, 1987-1996.....	46
18. Percent of lingcod caught by recreational anglers fishing North Gulf of Alaska waters that were released, 1991-1996.....	48
19. Length frequencies of lingcod sampled near Seward, 1987-1994.....	50

SECTION I: OVERVIEW

MANAGEMENT ARENA

The subject of this Fishery Management Report is the recreational fisheries for groundfish, specifically those for halibut, rockfish, and lingcod, that occur in the North Gulf of Alaska. In addition, a developing recreational fishery targeting salmon sharks in the North Gulf of Alaska is discussed. In this report, the North Gulf of Alaska includes all state waters of the Gulf of Alaska west of Cape Suckling; including the waters of Prince William Sound and Cook Inlet, and those waters surrounding the Kodiak Island Archipelago, Alaska Peninsula, and Aleutian Islands (Figure 1). The North Gulf of Alaska management area crosses several Region II sport fish management areas including the Central Gulf, Kenai Peninsula, and Kodiak/Alaska Peninsula management areas. Major communities that support significant recreational groundfish fisheries along the North Gulf Coast include Valdez, Whittier, and Cordova in Prince William Sound; Seward along the North Gulf of Alaska coast; Homer, Deep Creek, Ninilchik, and Anchor Point along Lower Cook Inlet; and Kodiak on the Kodiak Island Archipelago. The state's roadways and marine highway system provide good access to these locations and thus to most of the North Gulf of Alaska recreational groundfish fisheries. At present, little directed recreational effort or groundfish harvest occur along the Alaska Peninsula or Aleutian Islands.

Regulations governing North Gulf of Alaska recreational groundfish fisheries are found in Chapters 55 (Prince William Sound), 58 (Cook Inlet-Resurrection Bay Saltwater), 64 (Kodiak), and 65 (Alaska Peninsula-Aleutian Islands) of Title 5 of the Alaska Administrative Code. Statewide regulations and provisions, some of which apply to North Gulf of Alaska recreational groundfish and salmon shark fisheries, are found in Chapter 75.

Management and research functions for North Gulf of Alaska recreational groundfish fisheries are the responsibility of the Groundfish Management Biologist (Doug Vincent-Lang) stationed in Anchorage. An assistant (Scott Meyer) stationed in Homer supervises ongoing research projects and provides management assistance to the management biologist. A research project leader (Mike Bethe) stationed in Anchorage conducts groundfish stock assessment. A seasonal biologist and numerous seasonal technicians assist these positions.

FISHERIES OVERVIEW

The marine waters of the North Gulf of Alaska support numerous stocks of marine groundfish. Although many groundfishes are harvested by recreational anglers, the most commonly harvested species include various flatfishes (halibut *Hippoglossus stenolepis*, arrowtooth flounder *Atheresthes stomias*, and starry flounder *Platichthys stellatus*), rockfish species of the genera *Sebastes* and *Sebastolobus*, and greenlings (lingcod *Ophiodon elongatus*, kelp greenling *Hexagrammos decagrammus*, and rock greenling *Hexagrammos lagocephalus*). In addition, Pacific cod *Gadus macrocephalus*, walleye pollock *Theragra chalcogramma*, Pacific herring *Clupea harengus*, and sablefish *Anoplopoma fimbria* are commonly caught by recreational anglers. Given current angler interest, the primary groundfish species of management importance at present are halibut, rockfish, and lingcod. Although not a groundfish species, the salmon shark (*Lamna ditropis*) has recently become the target of a developing recreational fishery in the North Gulf of Alaska and is discussed in this report.



Figure 1.-Area of management responsibility for marine groundfishes in the North Gulf of Alaska.

All fisheries are supported solely on wild stocks. Although accessible by road, all North Gulf of Alaska recreational groundfish fisheries are considered remote because participation requires a boat or a guide. The cost to participate is, therefore, relatively high. Guided anglers make up a significant component of the North Gulf of Alaska groundfish fishery (particularly the halibut fishery).

Because of the availability of guides, these fisheries offer a range of angling opportunities for both experienced and inexperienced anglers.

ANGLING EFFORT

Recreational angler effort in Alaska has been estimated annually since 1977 using a mail survey (Mills 1979-1994, Howe et al. 1995-1997). This survey is used to generate estimates of the number of angler-days of sport fishing effort expended by recreational anglers fishing in Alaska and adjacent marine waters, and their harvest and release of select sport fishes. The survey is designed to provide these estimates on a site-by-site basis. Mills and Howe (1992) and Meyer (1994) have reviewed the postal survey and suggest that the estimates are sufficiently precise and accurate for management of "large" marine fisheries, such as those for halibut or rockfish. Some estimates for lingcod may not be accurate or precise given the small harvest of this species at some ports and angler confusion regarding species identification. Harvest of salmon sharks is currently not estimated from this survey.

The postal survey is not designed to provide estimates of effort directed towards a single species. Based on port sampling and creel survey results, the estimated effort generated using the mail survey has been apportioned to effort directed at select species. Although the accuracy of these apportionments cannot be checked at present, it is felt that they can be used to index the relative growth of fisheries targeting select species. In 1996, North Gulf of Alaska halibut, rockfish, and lingcod stocks supported just over 366,000 days of angling effort (Table 1). In comparison, these fisheries supported just 135,000 days of recreational angling effort in 1987. Effort has risen near annually (Figure 2). Effort is projected, however, to stabilize over the next several years as these fisheries become fully utilized and demand stabilizes.

The most popular of the North Gulf of Alaska recreational groundfish fisheries are those for halibut. During 1996, recreational anglers expended just over 312,000 angler-days fishing halibut in the North Gulf of Alaska (Table 1), representing about 85% of the total recreational groundfish effort during 1996. Most (61%) of this effort was expended in Cook Inlet, with the remainder expended along the North Gulf Coast and the outer areas of Prince William Sound, and in the waters surrounding the Kodiak Island Archipelago. Only a small amount of effort (<5,000 angler-days) has been expended along the Alaska Peninsula and Aleutian Islands. Rockfish have been the second most targeted groundfish species by recreational anglers, accounting for 10% (37,677 angler-days) of the recreational effort for groundfish during 1996 (Table 1). Most of the fishing effort for rockfish has occurred along the North Gulf Coast, in Prince William Sound, and Cook Inlet. Lingcod have become an increasing target of recreational anglers since 1987 and accounted for nearly 5% (16,267 angler-days) of the recreational groundfish effort during 1996 (Table 1). Most of the fishing effort for lingcod has occurred along the exposed coastline of the North Gulf of Alaska accessed from Seward. The amount of effort directed at other groundfish stocks has not been estimated to date.

Table 1.-Number of angler-days expended by recreational anglers fishing for halibut, rockfish, and lingcod in the North Gulf of Alaska, 1987-1996.

Fishery	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
<u>Halibut</u>										
Lower Cook Inlet	50,220	87,570	79,200	92,610	95,670	111,582	152,964	156,890	204,473	192,310
Kodiak	23,203	17,855	15,209	13,382	23,802	18,884	31,793	30,388	27,619	30,901
North Gulf	37,862	41,131	43,605	53,056	55,476	58,277	71,618	77,388	89,652	89,106
Combined	111,285	146,556	138,014	159,048	174,948	188,743	256,375	264,666	321,744	312,316
<u>Rockfish</u>										
Lower Cook Inlet	3,906	6,811	6,160	7,203	7,441	8,679	11,897	12,203	15,903	14,957
Kodiak	6,187	4,761	4,056	3,568	6,347	5,036	8,478	8,248	7,365	8,240
North Gulf	8,835	9,597	7,267	8,843	9,246	9,713	11,638	12,576	14,569	14,480
Combined	18,928	21,169	17,483	19,614	23,034	23,428	32,013	33,027	37,837	37,677
<u>Lingcod</u>										
Lower Cook Inlet	1,674	2,919	2,640	3,087	3,189	3,719	5,099	5,230	6,816	9,410
Kodiak	1,547	1,190	1,014	892	1,587	1,259	2,120	2,062	1,841	2,060
North Gulf	1,262	2,742	4,360	5,306	5,548	5,828	6,267	6,771	7,845	7,797
Combined	4,483	6,851	8,014	9,285	10,324	10,806	13,486	14,063	16,502	16,267
<u>Combined</u>										
Lower Cook Inlet	55,800	97,300	88,000	102,900	106,300	123,980	169,960	174,323	227,192	213,678
Kodiak	30,937	23,807	20,278	17,842	31,736	25,178	42,391	40,698	36,825	41,201
North Gulf	47,959	53,470	55,232	67,205	70,270	73,818	89,523	96,735	112,066	111,382
Combined	134,696	174,576	163,511	187,947	208,306	222,977	301,874	311,756	376,083	366,261

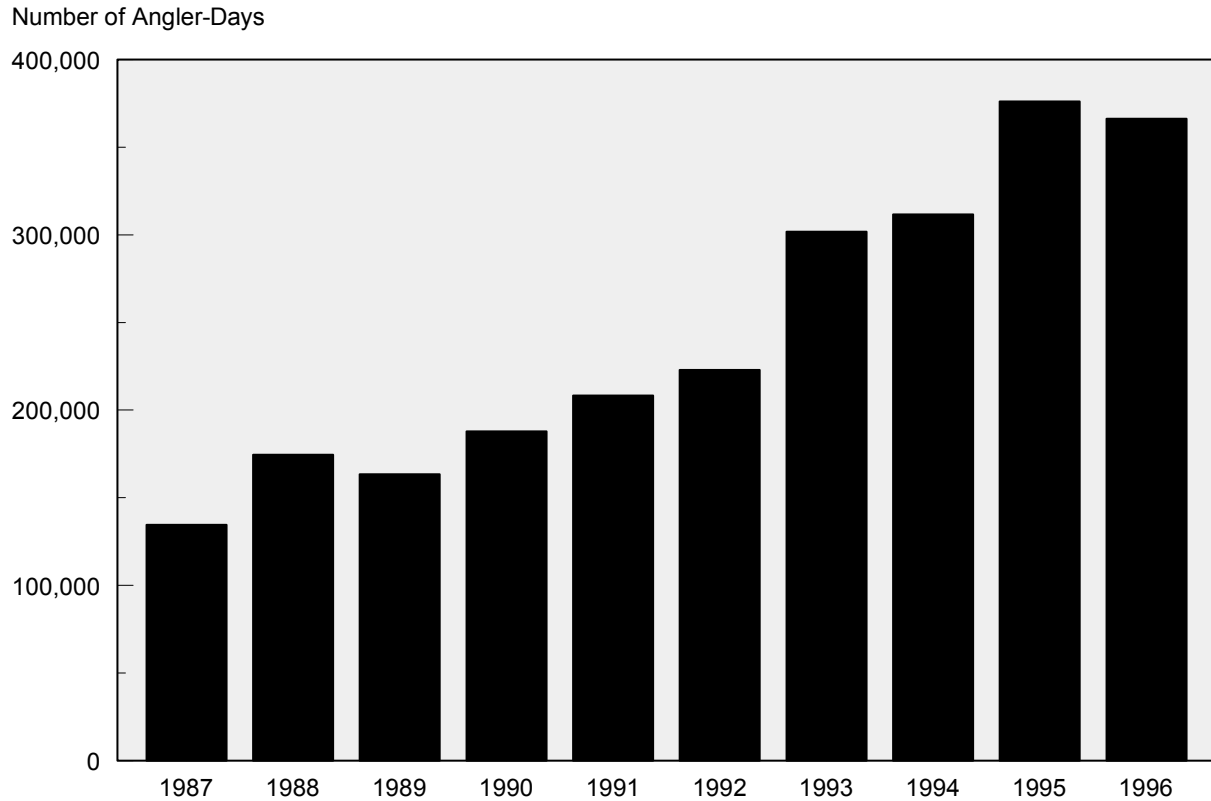


Figure 2.-Number of angler-days expended by recreational anglers fishing for halibut, rockfish, and lingcod in the North Gulf of Alaska, 1987-1996.

A fishery targeting salmon sharks has recently developed in the Central Gulf of Alaska. Currently, this fishery is limited to the ports of Seward, Cordova, and Valdez. Participation and harvest levels are unknown at present; however, both are expected to increase as public awareness and acceptance of the salmon shark as a viable big game fish increases.

A significant component of the annual effort expended in North Gulf of Alaska recreational groundfish fisheries is guided, particularly in the halibut fishery. Beginning in 1995, all companies providing sport fishing guide services were required by the State of Alaska to register in all areas of Alaska. Thus, accurate estimates of the numbers of companies and guides operating in this area are available for the first time. Based on this registration, 827 companies employing 1,218 guides registered with the Alaska Department of Fish and Game (ADF&G) in 1996 to provide marine charter services in ports along the North Gulf of Alaska (Table 2). This is a significant increase from 1995, partially due to better compliance with the registration requirement. In addition, about 25 guides are offered by the United States military for recreation in Seward and Valdez.

Chartered anglers accounted for 43% of the 1996 marine sport effort at Kodiak, 51% at Deep Creek/Anchor Point in Central Cook Inlet, 67% at Seward, 50% at Valdez, 74% at Yakutat, and 64% at Homer in Lower Cook Inlet (Table 3). Direct estimates of guided effort are unavailable for other areas of the North Gulf of Alaska; however, it is known that regional differences exist.

Table 2.-Number of companies and employed guides that registered with the department to provide sport fishing guide services in marine waters of the North Gulf of Alaska during 1995 and 1996.

Year	Companies	Guides
1995	359	701
1996	827	1,218

The department estimates that between 40% to 60% of the annual effort expended in marine waters of this overall area is chartered. Roth and Delaney (1989) have shown that catch rates of chartered anglers can be as much as five times higher than for nonchartered anglers.

ECONOMIC VALUE

The recreational fishery for groundfish is important to the economy of southcentral Alaska. In 1986, sport anglers spent \$18.6 million in pursuit of halibut in southcentral Alaska (excluding the Kodiak Island Archipelago; Jones and Stokes Associates, Inc. 1987). In addition, they indicated a net willingness to pay an additional \$25.2 million to ensure the continued availability of halibut fishing opportunities. Another survey (NPFMC 1997) estimated total expenditures directly attributable to halibut charter activity throughout Alaska in 1995 to be \$29 million. Of this total, the survey indicated that 25% was attributed to Alaskan residents and 75% to nonresident visitors. The economic value of other recreational groundfish fisheries has not been directly estimated.

Most port communities sponsor halibut derbies that offer lucrative prizes. These derbies attract anglers and support growing charter boat industries. The charter boat industry is an important economic component of the recreational fishery. For example, the Homer charter boat industry generated \$9.1 million in gross income for the Homer economy as well as an equivalent of 64 full-time, year-round jobs in 1985 (Coughenower 1986). Two-thirds of the chartered anglers surveyed stated they would not have come to Homer if charter services had not been available.

Table 3.-User group composition of the recreational fleet targeting groundfish at select North Gulf of Alaska ports, 1996.

Fishery	% Private	% Chartered
Yakutat	26	74
Kodiak	57	43
Deep Creek/Anchor Point	46	51
Homer	36	64
Seward	33	67
Valdez	50	50

MANAGEMENT AUTHORITIES

Halibut and their fisheries are managed under an international treaty, the Halibut Convention of 1953 and its 1979 Protocol. Under this treaty, the International Pacific Halibut Commission (IPHC) was formed to assure the optimal sustained yield of the North Pacific halibut resource. For purposes of management, the IPHC has divided the North Pacific halibut fishery into 10 regulatory areas, stretching from northern California to Alaska. Each year, the IPHC establishes catch quotas for each regulatory area which assure for the halibut stock's optimal sustained yield. These catch quotas represent the *maximum* number of halibut that can be harvested from each area annually and, under the treaty, total harvest by all user groups cannot exceed these quotas. The IPHC does not, however, have the authority to allocate the catch quota amongst the various fisheries exploiting the halibut stock in U.S. waters. In U.S. waters, the responsibility for allocation falls to the North Pacific Fishery Management Council (NPFMC) and the responsibility for management to the National Marine Fisheries Service (NMFS) via the Magnuson Fisheries Conservation and Management Act of 1976. The State of Alaska does not have direct management authority over halibut and their fisheries off Alaska. Alaska does, however, have management authority over the Alaskan charter fleet. The ADFG, Division of Sport Fish, provides technical data and other information to the IPHC, NPFMC, and NMFS to aid in making management and allocation decisions.

Harvest of nearshore rockfishes by recreational and commercial anglers fishing North Gulf of Alaska waters primarily occurs in state waters. Responsibility for management and allocation of rockfish in state waters lies with the Alaska Board of Fisheries (ABOF). The Division of Sport Fish takes the lead in managing the recreational fishery for rockfish while the Division of Commercial Fisheries Management and Development manages commercial rockfish fisheries. In adjacent federal waters, rockfish are managed under several federal fishery management plans adopted by the NPFMC. The NMFS has the lead management responsibility in federal waters. The federal fishery management plans do not specifically address recreational fisheries; thus, state regulatory authority for rockfishes extends into the U.S. Economic Exclusive Zone (EEZ).

Like rockfish, lingcod are primarily harvested in state waters. Responsibility for management and allocation of lingcod in state waters lies with the ABOF. The Division of Sport Fish takes the lead in managing the recreational fishery for lingcod while the Division of Commercial Fisheries Management and Development manages commercial lingcod fisheries. Lingcod are not currently managed under a federal fishery management plan. In 1995, state authority over management of the species was extended into federal waters of the U.S. EEZ given the absence of this species in the Gulf of Alaska fishery management plan.

FISHERY OBJECTIVES

Under the Halibut Convention of 1953 and its 1979 Protocol, North Pacific halibut stocks are managed for *optimum sustained yield*. Therefore, the objective of current management is to assure harvests do not exceed optimal sustained yields, as established annually by the IPHC, and remain within allocation schemes established annually by the NPFMC. For purposes of management, the IPHC has divided the North Pacific halibut fishery into 10 regulatory areas, stretching from northern California to Alaska. The North Gulf of Alaska falls within Regulatory Areas 3A, 3B, and 4.

The objective of rockfish management is to assure harvests do not exceed sustained yields and remain within established allocation schemes. The objective of lingcod management is to assure depressed stocks in and near to Resurrection Bay can rebuild to permit sustainable harvests, and to assure that harvests on healthy stocks do not exceed sustained yields and remain within established allocation schemes.

FISHERY EVALUATION PROGRAM

The Division of Sport Fish conducts a port-sampling program aimed at assessment of North Gulf of Alaska groundfish stocks and their recreational fisheries. The objectives of this research program are to estimate the species, age, sex, and size compositions of the groundfish harvests at select North Gulf of Alaska ports, and to characterize the recreational groundfish fisheries that occur at these ports. Ports sampled include Homer and Deep Creek in the Cook Inlet area, Seward along the North Gulf Coast, Valdez in Prince William Sound, and Kodiak along the Kodiak Island Archipelago. In 1997 the Division of Sport Fish initiated research aimed at assessment of stock structure and status of nearshore black rockfish populations near Seward. This is envisioned to be a multi-year project. Initial efforts are focussed on developing study methodologies and assessing stock structure and migration. The Division of Sport Fish also periodically conducts fishery-independent sampling of lingcod near Seward. The primary objective of this research program is to assess recruitment and recovery of lingcod near Seward. No sampling was conducted in 1995; but we plan to conduct these surveys again during 1998.

The division provides data collected from this research to the ABOF, the IPHC, and the NPFMC to aid decisions regarding management and allocation of North Gulf of Alaska groundfish resources.

MAJOR ISSUES

Halibut

The NPFMC took three actions at their September 1997 meeting affecting charter boats fishing halibut off Alaska:

1. The NPFMC voted to establish guideline harvest limits (GHL) for the recreational halibut charter fishery in Regulatory Areas 2C (southeast) and 3A (southcentral) off Alaska. This action was taken to address what the NPFMC perceived to be rapid, uncontrolled growth of the guided sport halibut charter industry in Alaska. In taking this action, the NPFMC believed that further growth of the sport fishery was inevitable and that without some type of restriction, the growth would result in a reallocation of halibut from the traditional directed longline fishery, given that the resource is currently fully utilized. The NPFMC believed growth of the halibut charter industry was resulting in economic and social costs to traditional commercial setline and nonguided recreational halibut fisheries. The NPFMC is currently working on the development of management guidelines to implement the guideline harvest limits. Until these management guidelines are developed and the GHLs are exceeded, the GHLs will not be actively managed for. Increases in the biomass of halibut in Areas 2C and 3A make it improbable that the GHLs will be exceeded in either of these two regulatory areas for the next several years. Ultimate responsibility for management of these GHLs will lie with the National Marine Fisheries Service.

2. The NPFMC voted to develop local area management plans for halibut fisheries at ports where allocation conflicts are present. The NPFMC asked the ABOF to take the lead in the development of these plans. In taking this action, it is hoped that these plans will alleviate user conflicts in the marine waters near these ports. The ABOF has proposed developing these plans as part of their normal regulatory cycle. Under this approach, Cook Inlet, Lower Cook Inlet, and Kodiak are up for consideration during the 1998/99 cycle; Prince William Sound and southeast Alaska during the 1999/2000 cycle; and the Alaska Peninsula during the 2000/01 cycle. A variety of measures, including moratoriums, harvest caps, and/or exclusion zones for all fisheries, could be implemented as part of a local plan. Portions of developed plans affecting halibut will need to be approved by the NPFMC.
3. The NPFMC recommended implementing record keeping and reporting requirements for charter boat operators, lodges, and outfitters who fish for halibut. The NPFMC recommended that this requirement be developed through the ABOF and the information be gathered by the ADFG. The NPFMC requested that the reports include catch figures, locations of catch, number of clients, residence information of clients, ownership of vessels, and identity of operators. The ABOF agreed to consider implementing reporting requirements, and is scheduled to discuss these requirements at their February statewide finfish meeting. In anticipation, the department will implement a statewide logbook program for marine charters in 1998.

Concern has been raised that the halibut Individual Fishery Quota (IFQ) system will result in increased competition on the fishing grounds between commercial fishermen and sport anglers. Under the new IFQ system, commercial halibut fishermen have up to 8 months to catch their annual individual halibut quota. Under the old system, commercial halibut fishermen had, at maximum, up to two 24-hour periods to catch an area quota. Competition was minimal in the past because the commercial fishery operated far offshore where the abundance of large halibut was higher during spring and fall commercial openings. The long season permissible under the IFQ system will allow overlap of commercial and sport fishing times. In addition, the commercial fleet will likely fish close to port. Implementation of an IFQ system in Canada resulted in a significant number of vessels fishing closer to port, despite lower catch rates. These concerns have caused some recreational fishing groups to discuss establishment of exclusion zones for the commercial fishery that encompass their traditional fishing areas near major sport ports. As can be expected, such proposals have not been well received by commercial fishermen. Observations and discussions with fishermen during the first couple seasons of the IFQ fishery suggest that some conflict between user groups has occurred as a result of small-quota IFQ holders fishing closer to port. Development of local area management plans (see above) should help alleviate these concerns.

Lingcod

Lingcod stocks in Resurrection Bay are severely depressed and are closed to both commercial and recreational fisheries until the stocks recover to permit a sustainable harvest, likely many years to come. Lingcod stocks near Resurrection Bay are depressed and recreational fisheries operating in these areas have been restricted to permit stocks to recover. Depressed stocks are being monitored to evaluate their recovery. Recovery of stocks is being evaluated

through collection of fishery-independent length statistics to evaluate time-series trends in recruitment. Lingcod stocks in other areas of the North Gulf of Alaska are healthy, but targeted fisheries are managed under appropriate regulations given the susceptibility these stocks have shown to overharvest. Healthy stocks are being monitored through the port sampling program to evaluate trends in age and length compositions.

Rockfish

Rockfish stocks of the North Gulf of Alaska are managed primarily for commercial and recreational uses. In recent years, commercial harvests have exceeded sport harvests in most areas of the North Gulf of Alaska. However, in some areas, notably along the North Gulf of Alaska near Seward, recreational harvests in some years exceed commercial harvests. Unfortunately, there is a lack of data to assess either the sustained yields or current status of North Gulf of Alaska rockfish stocks. Thus, it is unknown at present whether current harvest levels are sustainable. Concern has been raised that some demersal rockfish species, particularly the longer-lived species such as yelloweye rockfish, are being overfished. Given the lack of data, recreational fisheries targeting North Gulf of Alaska rockfish stocks are managed under relatively restrictive regulations. To offer more protection to demersal shelf rockfish species, the ABOF at the request of the department has recently established more restrictive regulations for recreational rockfish fisheries in the Seward area of the North Gulf of Alaska. These regulations reduce daily bag and possession limits for nonpelagic rockfish such as yelloweye rockfish. In addition, data are being collected to form a long-term database of selected fishery and stock assessment parameters that can be used to assess the sustained yields of North Gulf of Alaska rockfish stocks. Towards this objective, the Division of Sport Fish recently initiated research aimed at assessment of stock structure and status of nearshore black rockfish populations near Seward. This is envisioned to be a multi-year project. Initial efforts are focussed on developing study methodologies and assessing stock structure and migration. Consideration is also being given to establishing marine fishing reserves to protect demersal rockfishes.

Concern has been raised that commercial rockfish and lingcod harvests may increase as a result of a new Individual Fishery Quota (IFQ) system enacted for the Alaskan commercial halibut fishery during 1995. Under the new IFQ system, commercial halibut fishermen have up to 8 months to catch their annual individual halibut quota. Under the old system, commercial halibut fishermen had, at maximum, up to two 24-hour periods to catch an area quota. This resulted in an incentive to fish clean, as bycatch during severely time-restricted openings resulted in reduced landing of halibut. Because bycatch in nearly all cases is lower in value than halibut, it resulted in a reduced value of the landing. There is a fear that, because time is not limited under the new system, bycatch will increase. For species with a high exploitable biomass, this is not viewed as a problem. However, for species such as rockfish which have a very low exploitable biomass, or lingcod for which there are identified stock conservation concerns, increased bycatch may result in overharvest. Department managers are considering asking the ABOF for permission to close areas in which rockfish or lingcod quotas have been achieved to commercial longline fishing to avoid further rockfish or lingcod bycatch. Observations during the first several seasons of IFQ fishing suggest that some increase in harvest of nontarget species has occurred. A recent legal opinion to the

ABOF grants the department the authority to close halibut fisheries in state waters if a stock conservation problem for a state-managed species can be demonstrated.

Salmon Sharks

Concern has been raised regarding the sustainability of recently developed recreational and commercial fisheries targeting salmon sharks in the North Gulf of Alaska. Little information is available to assess either the structure or status of target stocks. This, coupled with available life history information which suggests this species can be easily overexploited, has lead the department to propose agenda change requests to the ABOF seeking to establish:

1. A statewide Recreational Salmon Shark Fishery Management Plan containing provisions for daily bag and possession limits and seasonal limits, and
2. Permit requirements and harvest limits for commercial fisheries.

The ABOF has accepted these requests and has scheduled discussion for February 1998.

Guide Licensing

A bill (HB 175) has been introduced to the Alaska State Legislature to establish licensing requirements for businesses and individuals who provide sport fish guiding services in Alaska, and mandatory reporting requirements for this industry. The bill is the result of a convergence of ideas by several parties. The comprehensive licensing system established in the bill is needed to better define this diverse industry. The proposed licensing system also provides needed definitions for companies and individuals who provide sport fishing guiding, chartering, and outfitting services. Through such definitions, it is hoped that the industry can be more fully identified and organized. It is also believed that the definitions will close loopholes in current definitions, thereby providing a level playing field for the industry and better enforcement of regulations pertaining to sport fishing guides and charters. It is also hoped that comprehensive licensing will add stability to this economically important industry, which supports many jobs throughout Alaska. Insurance requirements for companies and safety requirements for guides are stipulated to assure that anglers utilizing this industry are protected, and a professional level in service is maintained. The proposed license package also establishes fees and mandatory reporting requirements that provide the needed foundation to help management agencies build a reasonable and stable regulatory environment to assure the long-term health of both the industry and the resource it depends upon. The department supports this legislation and is working to see that it is adopted into law. Similar intent has been proposed in the form of a regulation proposal to the ABOF. This proposal is scheduled for consideration by the ABOF in February 1998.

SECTION II: FISHERIES

NORTH GULF OF ALASKA RECREATIONAL HALIBUT FISHERY

Halibut and their fisheries are managed under an international treaty, the Halibut Convention of 1953 and its 1979 Protocol. Under this treaty, the International Pacific Halibut Commission (IPHC) was formed to assure for the optimal sustained yield of the North Pacific halibut resource. Under the treaty, the IPHC annually recommends harvest levels to the governments of the United States and Canada that assure the optimal sustained yield of the North Pacific halibut resource.

For purposes of management, the IPHC has divided the North Pacific halibut fishery into 10 regulatory areas stretching from northern California to Alaska (Figure 3). Regulatory Area 3A, which extends from Cape Spencer eastward to Cape Trinity on the southern end of Kodiak Island, encompasses most of the North Gulf of Alaska. The south side of the Alaska Peninsula south of Cape Trinity falls into Regulatory Area 3B. The waters surrounding the Aleutian Islands fall into Regulatory Area 4.

In United States waters the responsibility for allocation of catch amongst fisheries falls to the NPFMC via the Magnuson Fisheries Conservation and Management Act of 1976. The IPHC does not have the authority to allocate catch amongst the various fisheries exploiting the halibut stock in U.S. waters. It does, however, through agreements with the NPFMC, maintain some management authority over various fisheries, notably the directed longline fisheries. Management authority for halibut fisheries falls to the NMFS via the NPFMC. The state of Alaska does not have direct management or allocative authority over halibut and their fisheries off Alaska. The Alaska Department of Fish and Game, Division of Sport Fish does, however, provide technical data and other information to both the IPHC and the NPFMC to aid in making stock assessment and allocation decisions.

The limits for the halibut sport fishery off Alaska are currently 2 fish per day, 4 fish in possession coastwide. The fishery is open year-round with the exception of January, when the fishery is closed to protect spawning halibut. The January closure is essentially meaningless, given that few anglers currently fish halibut during January in the North Gulf of Alaska. Unlike the commercial fishery which has a 32-inch minimum size limit, there are no size restrictions placed on the recreational fishery.

The halibut sport fishery is of major importance to the economy of Alaska. The NPFMC (1997) estimated total expenditures directly attributable to halibut charter activity throughout Alaska in 1995 to be \$29 million. Of this total, the survey indicated that 25% was attributed to Alaskan residents and 75% to nonresident visitors. Specific to southcentral Alaska, anglers spent \$18.6 million in 1996 in the pursuit of halibut, and indicated a willingness to pay an additional \$25.2 million to ensure the continued availability of halibut fishing opportunities (Jones and Stokes Associates, Inc. 1987). Many charter services provide guided sport fishing opportunities for halibut. In 1985, the Homer halibut charter industry generated \$9.1 million in gross income for the Homer economy as well as an equivalent of 64 full-time, year-round jobs. Two-thirds of chartered anglers surveyed said they would not have come to Homer if charter services had not been available (Coughenower 1986). In addition, proceeds from halibut derbies are often donated to support a variety of community projects and organizations.

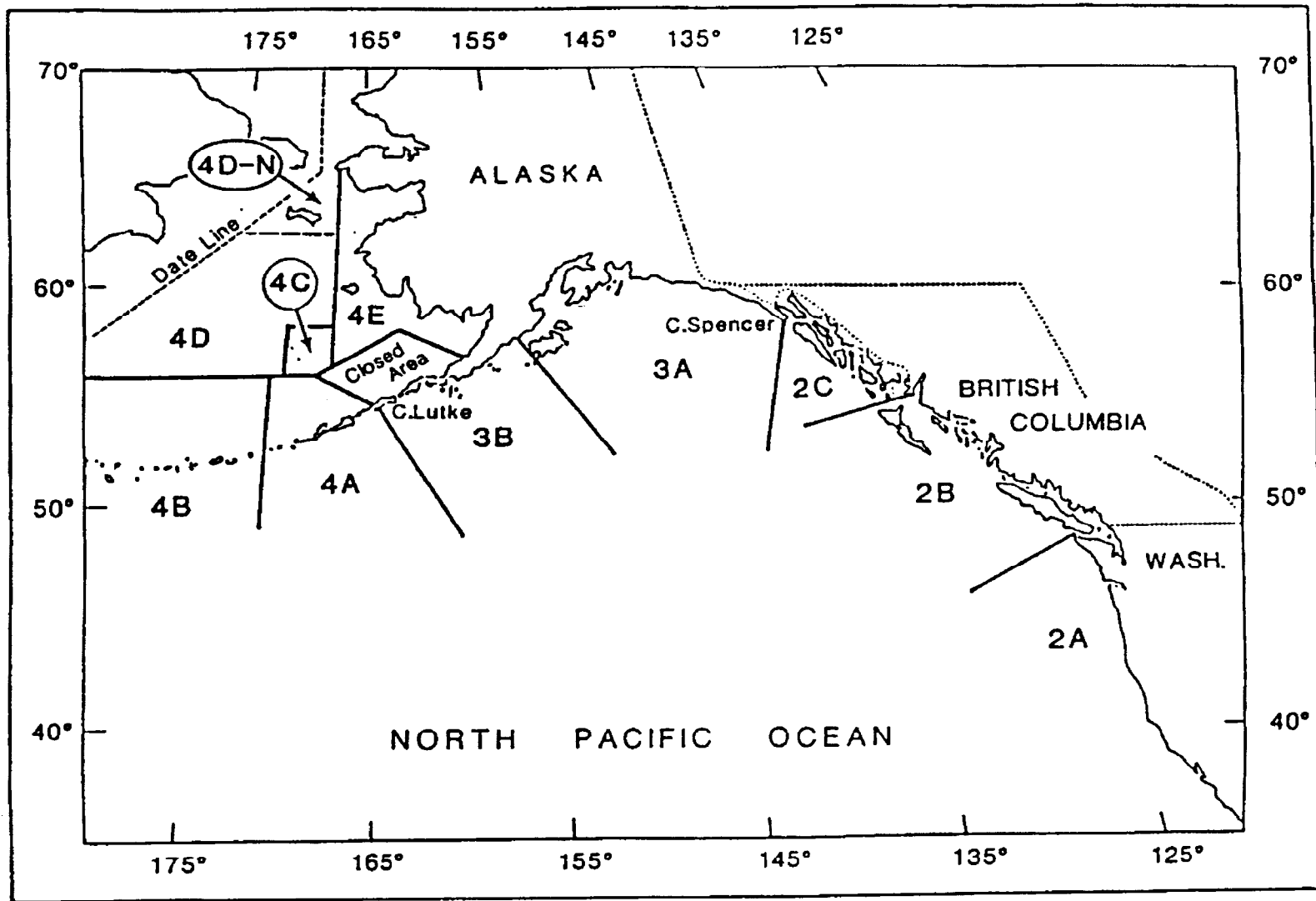


Figure 3.-Regulatory areas established by the International Pacific Halibut Commission to manage North Pacific halibut stocks.

Management Objective and Approach

A constant exploitation strategy is employed by the IPHC to manage North Pacific halibut stocks for *optimum sustained yield*. The IPHC meets annually in January to calculate the exploitable biomass (yield) available for harvest in each of the 10 regulatory areas. A constant exploitation yield (CEY) is calculated for each regulatory area as the estimated exploitable biomass available times a 0.30 exploitation rate. Each CEY thus represents the total allowable harvest (in pounds) for each regulatory area.

After calculation of each CEY, the IPHC estimates the sport (based on a 2 fish daily bag limit and 4 fish possession limit and February 1 through December 31 open season) and personal use/subsistence harvests and wastage and bycatch mortalities for each regulatory area. These are subtracted from the CEY on a regulatory area basis. The remainder is the quota for the commercial halibut IFQ fishery.

This factoring of the catch has, to the present, been done by the IPHC and the final numbers approved by the NPFMC on an annual basis. Under this management approach, each CEY changes annually, reflective of the estimated biomass of exploitable halibut present (i.e., quotas are lower during years of low exploitable biomass and higher during years of high exploitable biomass). The North Pacific halibut stock is fully utilized.

In 1997, the NPFMC voted to establish guideline harvest limits (GHL) for the recreational halibut charter fishery in Regulatory Areas 2C (southeast) and 3A (southcentral) off Alaska. The NPFMC is currently working on the development of management guidelines to implement the guideline harvest limits. Until these management guidelines are developed and the GHLs are exceeded, the GHLs will not be actively managed for. When this occurs, the estimated harvest of halibut by the halibut charter fishery will no longer be removed “off the top.” Instead, the remainder of the CEY after personal use/subsistence harvests and wastage and bycatch mortalities for each regulatory area are removed, will be divided between the commercial IFQ and charter halibut fisheries. The GHLs were set at 12.76% and 15.61% of the combined commercial and guided sport halibut total allowable catch (TAC) in Areas 2C and 3A, respectively. As such, the GHLs are not a fixed number, rather “caps” that float with future TACs. No GHLs were set for areas west of Area 3A.

Stock Status

In 1996, the IPHC reviewed its stock assessment model and determined that the population of halibut in the North Pacific is much larger than previously thought. Instead of declining at a rate of 5%-10% per year as earlier projected (Sullivan 1992), the biomass of halibut has increased, making more halibut available for harvest. This “correction” is expected to peak in 1998, when the available yield is projected to increase by about 20%-30%. Part of the reason for this change is a decrease in the length at age of halibut by 20% and in weight by up to 50% over the last decade. Because of this, previous conclusions regarding poor recruitment were deemed invalid.

Fishery Overview

Regulatory Area 3A

Halibut are a popular target of recreational anglers fishing Regulatory Area 3A waters. During 1996, recreational anglers expended about 312,000 angler-days fishing for halibut in this regulatory area (Table 4). In comparison, recreational anglers spent about 111,000

Table 4.-Number of angler-days expended by recreational anglers fishing for halibut in the North Gulf of Alaska, 1987-1996.

Fishery	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Lower Cook Inlet	50,220	87,570	79,200	92,610	95,670	111,582	152,964	156,890	204,473	192,310
Kodiak	23,203	17,855	15,209	13,382	23,802	18,884	31,793	30,388	27,619	30,901
Central Gulf	37,862	41,131	43,605	53,056	55,476	58,277	71,618	77,389	89,652	89,106
Combined	111,285	146,556	138,014	159,048	174,948	188,743	256,375	264,666	321,744	312,316

angler-days fishing halibut in these waters during 1987. Growth has been near annual (Figure 4) but has stabilized over the past several years due to a variety of factors (Vincent-Lang and Meyer 1993). The waters of Cook Inlet account for about 60% of the annual effort (Table 4).

As with directed effort, the sport harvest of halibut from Regulatory Area 3A waters has also grown steadily, from 18,000 halibut in 1977 to 257,000 halibut in 1996 (Table 5, Figure 5). The 1996 harvest was a record for Area 3A waters. Most halibut in the Area 3A recreational fishery are harvested from May through September. Beginning in 1993, some charter services began offering charters during April and October; however, only a few charters were booked. Weather and lack of interest were the likely reasons for the low bookings.

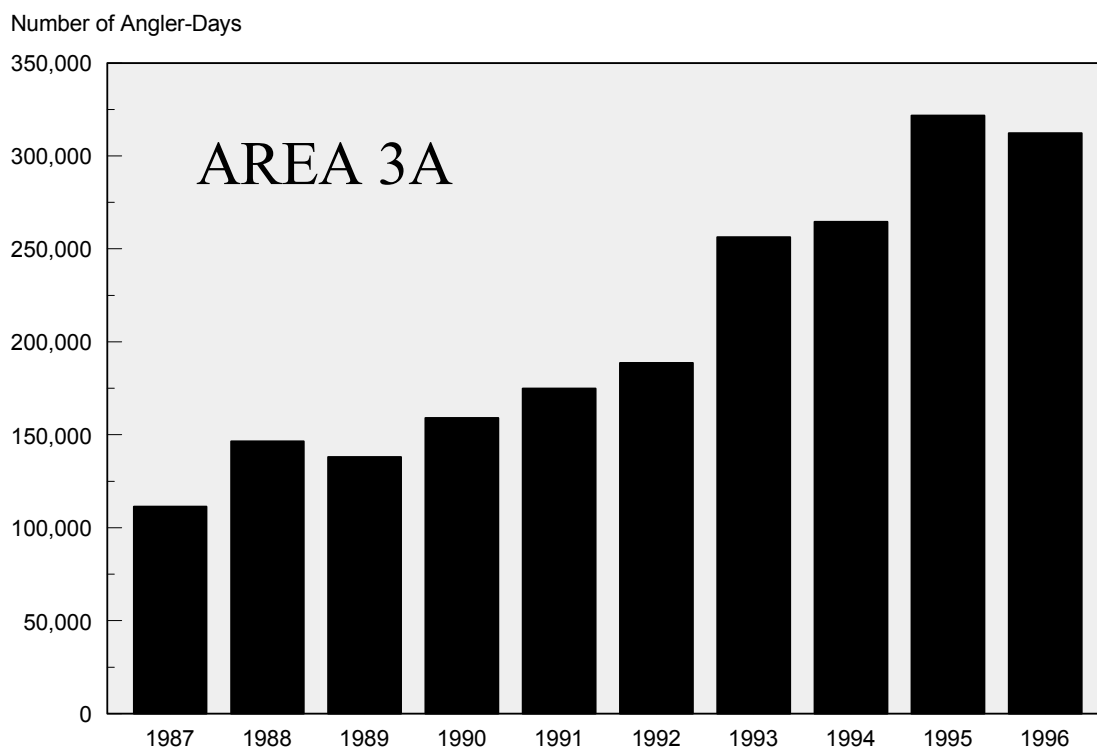


Figure 4.-Number of angler-days expended by recreational anglers fishing for halibut in IPHC Regulatory Area 3A, 1987-1996.

Table 5.-Number of halibut harvested by recreational anglers fishing in IPHC Regulatory Area 3A, 1977-1996.

Year	Kodiak	Cook Inlet	North Gulf Coast	PWS	Yakutat	Total Area 3A	Alaska	Percent Area 3A
1977	994	13,466	1,705	1,247	428	17,840	23,244	76.8
1978	1,721	25,577	2,723	933	24	30,978	37,085	83.5
1979	3,013	26,997	2,902	1,691	78	34,681	47,705	72.7
1980	3,651	29,985	3,017	3,143	34	39,830	64,658	61.6
1981	6,858	38,721	3,443	2,495	65	51,582	74,212	69.5
1982	9,180	39,532	2,954	2,735	398	54,799	92,358	59.3
1983	8,545	60,126	2,619	3,493	682	75,465	117,042	64.5
1984	8,179	61,202	3,267	4,428	241	77,317	124,950	61.9
1985	7,303	63,158	5,934	4,527	520	81,442	127,634	63.8
1986	10,960	85,153	10,398	8,331	777	115,619	160,885	71.9
1987	9,869	78,431	7,171	4,379	1,194	101,044	145,829	69.3
1988	7,749	137,252	11,696	9,845	1,673	168,215	225,106	74.7
1989	10,435	126,917	7,251	8,697	772	154,072	229,016	67.3
1990	9,134	148,538	9,500	10,851	1,459	179,482	247,202	72.9
1991	12,089	148,646	13,818	12,733	2,112	189,398	266,523	71.1
1992	10,860	143,094	18,595	17,855	1,861	192,265	264,943	72.6
1993	14,169	162,413	25,525	19,716	2,752	224,575	313,147	71.7
1994	14,910	170,801	25,009	23,487	3,577	237,784	329,046	72.3
1995	13,989	168,154	23,679	24,771	2,456	233,049	325,188	71.7
1996	14,639	192,666	23,853	22,786	3,072	257,016	333,982	77.0

The Area 3A recreational fishery is important on a statewide as well as coastwide basis. Recent Area 3A sport harvests made up about 77% (in number) of the total Alaskan recreational halibut harvest (Table 5; Mills 1979-1994, Howe et al. 1995-1997). On a larger scale, the 1996 sport harvest in Area 3A made up about 65% (by weight) of the entire recreational halibut harvest on the North American west coast (IPHC 1997).

The IPHC estimates harvest based on pounds rather than numbers of fish harvested. Numbers of fish recreationally harvested each year are converted to pounds of fish harvested based on sampling of recreational harvests to estimate the mean weight of harvested fish at various ports throughout southcentral Alaska (Meyer 1994, 1996). Because the mean weight of recreationally-harvested halibut has remained stable or decreased over time, the number of pounds of halibut

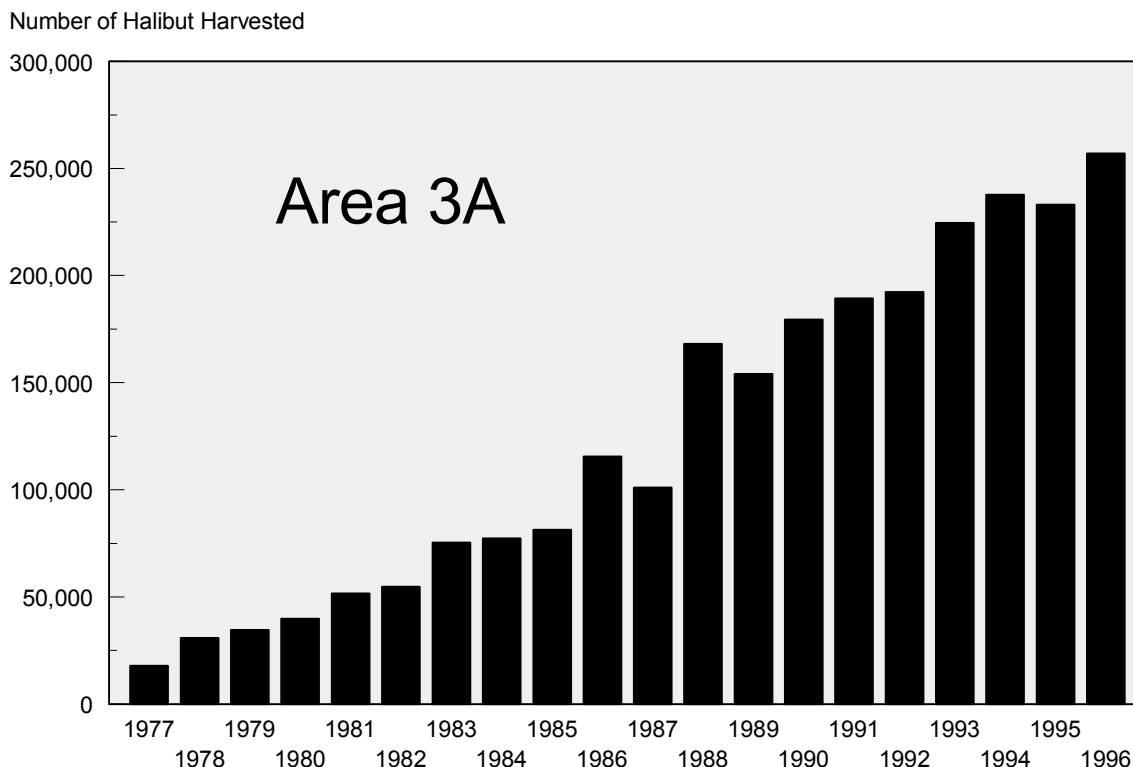


Figure 5.-Number of halibut harvested by recreational anglers fishing for halibut in IPHC Regulatory Area 3A, 1977-1996.

removed has decreased in spite of the increase in the number of halibut harvested (Table 6, Figure 6). This information suggests that the rapid rate of growth in sport removals evident throughout the 1980s and early 1990s may have ended.

Area 3A anglers released an estimated 31% to 49% of the halibut they caught during the period 1990-1996, or 86,000-238,000 fish per year (Table 7). In support of this estimate, an onsite creel survey estimated that 37% of halibut caught by the Valdez fleet were released in 1988 (Roth and Delaney 1989). Assuming a release mortality of 5% for sport-caught halibut, this amounts to a maximum of about 12,000 more halibut being killed annually in Area 3A.

The Alaska Department of Fish and Game, in conjunction with the IPHC, has projected the growth of the sport harvest through the year 2000. Actual harvests during 1992 and 1994-1996 were below the projection while the actual estimated harvest during 1993 was above the projection (Figure 7). While projections into the future are difficult, it appears that growth in this fishery may have tapered from past projections.

Although recreational harvests have increased in recent years, other sources of removals (e.g., commercial harvests and bycatch and wastage in other fisheries) continue to vastly outnumber recreational harvests in Area 3A (Figure 8). For example, during 1996 the directed longline fishery accounted for removals of 20.4 million pounds of halibut and other commercial removals (personal use, waste and bycatch) an additional 3 million pounds. In comparison, the Area 3A recreational harvest was 4.9 million pounds.

Table 6.-Number of pounds of halibut harvested by recreational anglers fishing in IPHC Regulatory Area 3A, 1977-1996.

Year	Number	Millions Pounds (net weight)
1977	17,840	0.196
1978	30,978	0.282
1979	34,681	0.365
1980	39,830	0.488
1981	51,582	0.751
1982	54,799	0.716
1983	75,465	0.945
1984	77,317	1.026
1985	81,442	1.210
1986	115,619	1.908
1987	101,044	1.989
1988	168,215	3.264
1989	154,072	3.005
1990	179,482	3.638
1991	189,398	4.236
1992	192,265	3.900
1993	224,575	5.265
1994	237,784	4.487
1995	233,049	4.488
1996	257,016	4.823

Regulatory Area 3A is composed of many regional and local recreational fisheries that are conducted in more or less separate geographic areas and possess distinctive patterns of harvest and use. The vast majority of harvest is taken in four major fisheries: Cook Inlet, Kodiak, North Gulf Coast (Seward), and Prince William Sound (Figure 9). A local fishery based in Yakutat harvests an insignificant number of fish and will not be discussed. The following descriptions of these fisheries is taken from Meyer (1994).

Cook Inlet

The Cook Inlet fishery is the largest local recreational halibut fishery in North America and has grown rapidly. Estimated harvest in this fishery has increased from 13,500 fish in 1977 to 193,000 fish in 1996 (Table 8). Since 1977, the Cook Inlet fishery has accounted for 72% to 83% (in number) of the Area 3A recreational harvest. The 1996 Cook Inlet harvest made up about 75% (by number) of the Area 3A harvest (Table 8). The proportion of the sport harvest

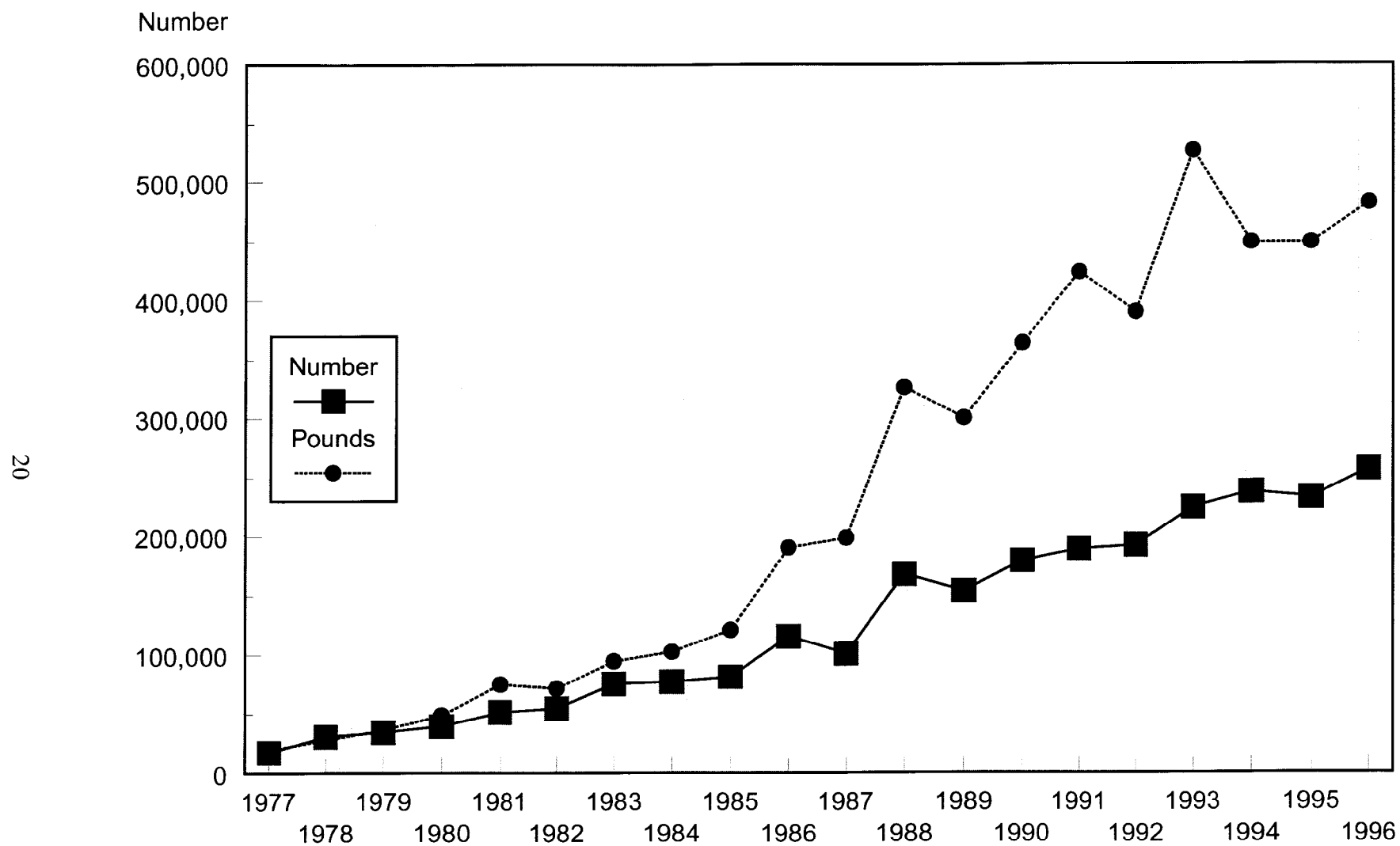


Figure 6.-Number and pounds of halibut harvested by recreational anglers fishing for halibut in IPHC Regulatory Area 3A, 1977-1996.

Table 7.-Estimated halibut catch, harvest, and percent of catch released in the Area 3A recreational fishery, 1990-1996.

Year	Catch	Harvest	Release	% Released
1990	332,025	179,482	152,543	46
1991	275,044	189,398	85,646	31
1992	333,552	192,265	141,287	42
1993	442,830	224,575	218,255	49
1994	390,245	237,784	237,461	39
1995	439,676	233,049	206,627	47
1996	494,869	257,016	237,853	48

caught by chartered anglers in Cook Inlet has steadily risen since 1986, peaking in 1995 at 66% (Figure 10). During 1996, chartered anglers accounted for 58% of the reported sport harvest from Cook Inlet waters, indicating the rate of growth in the charter fishery may have tapered.

The Cook Inlet fishery can be divided into two areas: Central Cook Inlet (CCI) consisting of waters north of the latitude of Anchor Point, and Lower Cook Inlet (LCI) consisting of waters south of Anchor Point, west to Cape Douglas, and east to Gore Point (Figure 11). Major access points in CCI include boat ramps and beach launch sites at Deep Creek, Ninilchik and Anchor Point. The Homer harbor is the primary access point for the LCI fishery, with relatively small numbers of boats also originating from Seldovia and other communities on the south side of Kachemak Bay. Boats based out of Homer fish primarily south of Anchor Point (Meyer 1992; pp. 46-50) but may range as far south as the Barren Islands and as far east as Port Dick. Boats launching in CCI generally fish the eastern half of Cook Inlet north of Anchor Point. Halibut are rarely caught north of the mouth of Kenai River.

Harvest in CCI has increased every year since 1987 (Table 8). Most of the increase in CCI has been due to a rapidly expanding charter fleet, particularly at Deep Creek. During the past 5-6 years an increasing number of guides have been operating out of CCI, particularly Deep Creek, as improved boat launching facilities have been constructed. Harvest in this fishery has begun to stabilize, as the fishery becomes fully utilized.

In comparison, the LCI harvest has been relatively stable, until 1996 when harvest peaked at 107,704 halibut (Table 8). The stable and variable harvest in LCI over the period 1988-1995 was probably not due to a proportional decrease in fish abundance. More likely, the Deep Creek and Anchor Point fisheries were capturing the business of anglers that formerly fished at Homer. Kenai River guides are reportedly moving to Deep Creek to circumvent restrictions on the Kenai River chinook salmon fishery. In addition, the CCI saltwater fishery offers opportunities to harvest chinook salmon as well as halibut, is a shorter drive from Anchorage than Homer, and is a shorter and often smoother boat ride to the fishing grounds. Use of tractors to launch boats from the beach has reduced competition at boat ramps and allowed launching of larger boats on any tide. The reason for the spike in LCI harvest in 1996 is unknown, but may be related to better marketing by the Homer fleet and an increased abundance of halibut.

Million Pounds of Halibut Harvested

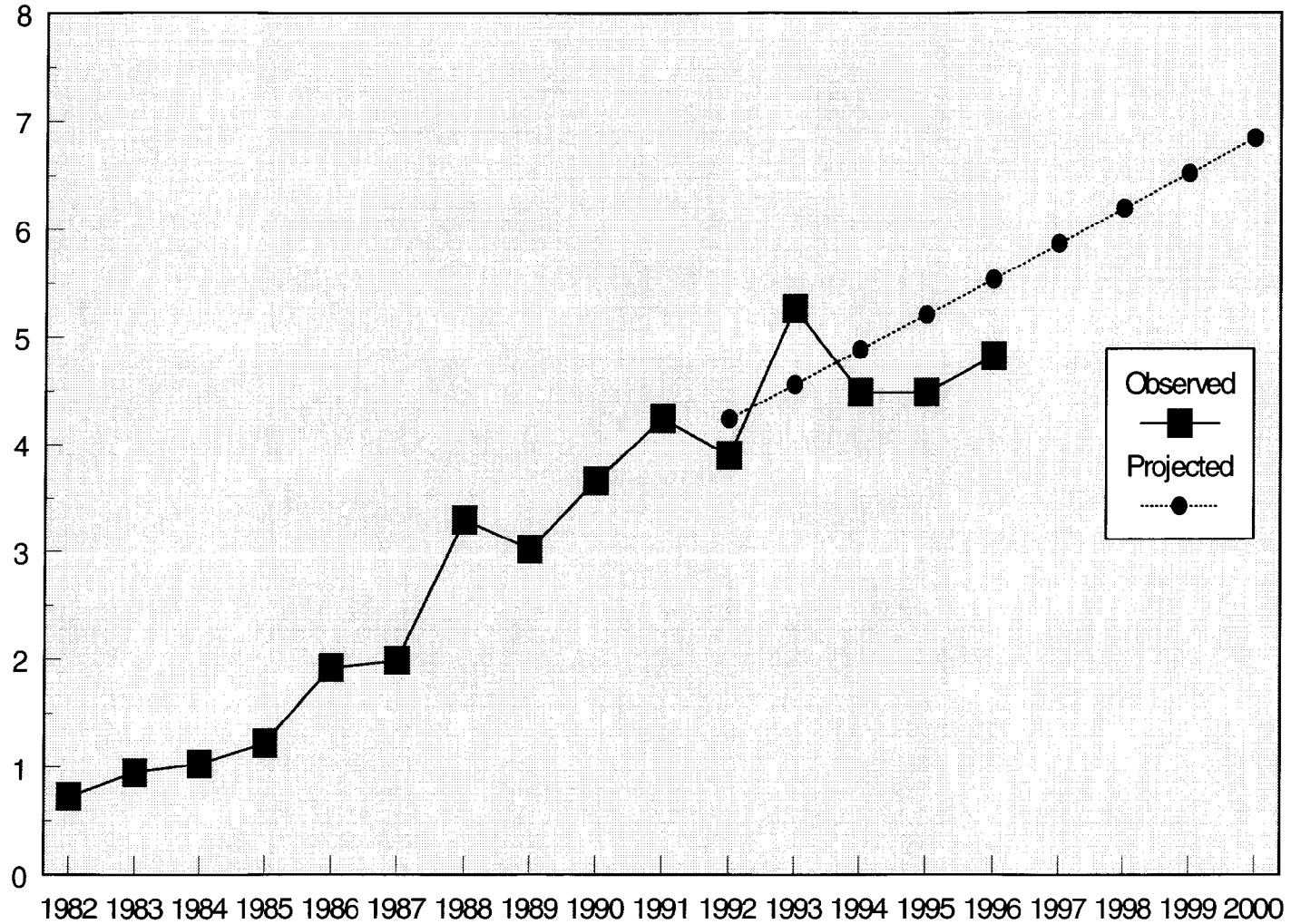


Figure 7.-Observed and projected growth in halibut harvests by recreational anglers (chartered and nonchartered) in IPHC Regulatory Area 3A through the year 2000.

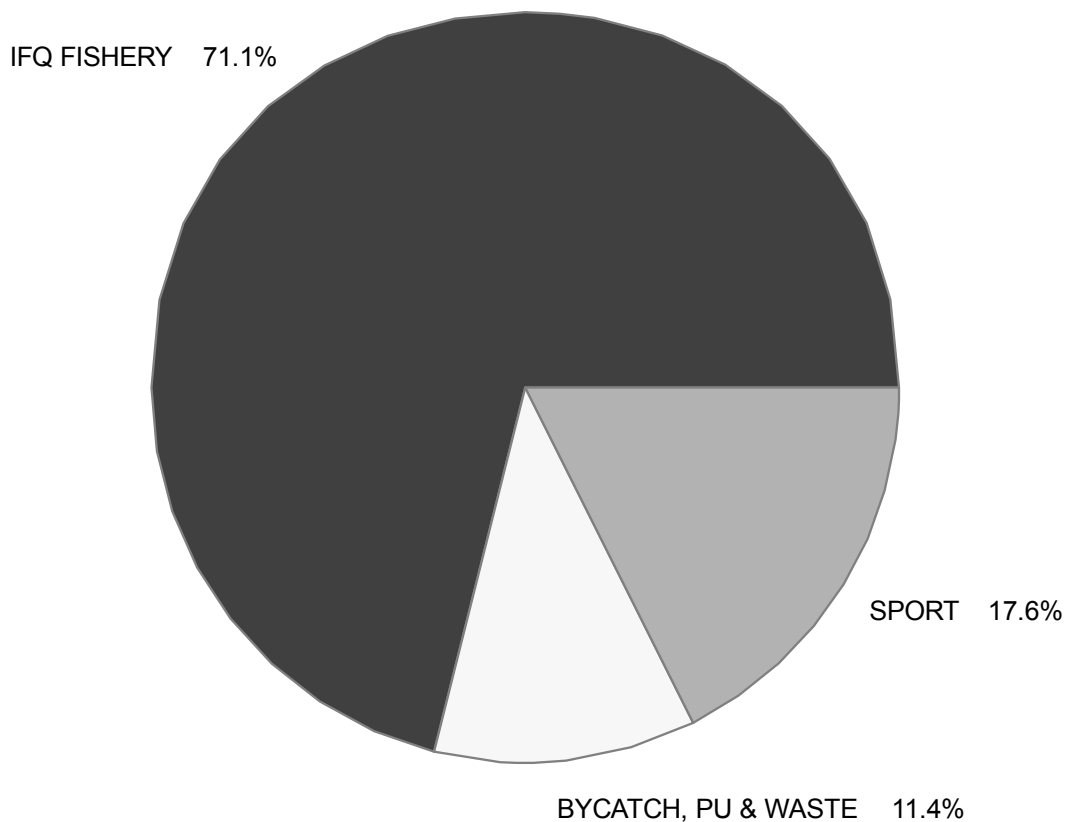


Figure 8.-Removals of halibut in IPHC Regulatory Area 3A during 1996.

Kodiak

Halibut are harvested from numerous locations surrounding Kodiak and Afognak islands, but the vast majority of the harvest is taken in Chiniak Bay and other waters close to the port of Kodiak. Most boats based in Kodiak fish north of Cape Chiniak and only occasionally venture farther west than Whale Island and as far north as the north side of Marmot Bay (Figure 12). The most heavily fished waters are in the vicinity of Buoy 4, Spruce Cape, Woody Island, and Long Island, all less than 20 km from port.

Although Kodiak is the hub of a thriving commercial longline fishery for halibut, the sport fishery is of much lower magnitude. Harvest in the Kodiak area, including waters surrounding Kodiak, Afognak, and the Barren islands, grew from about 1,000 fish in 1977 to 14,900 in 1994 (Table 5). The 1994 Kodiak harvest made up only 6% (in number) of the Area 3A total harvest. The port of Kodiak supports an active charter fleet of about a dozen boats, but most effort and harvest is by unguided anglers. Growth of the fishery will probably be limited by the geographic isolation of the area and the high cost of transportation.

North Gulf Coast

Although the port of Seward is the only access point, this fishery ranges over an extremely large geographic area. Boats occasionally fish as far west as Nuka Bay and as far east as Cape Cleare, a maximum distance of 110 km from Seward (Figure 13). Most of the halibut effort and harvest,

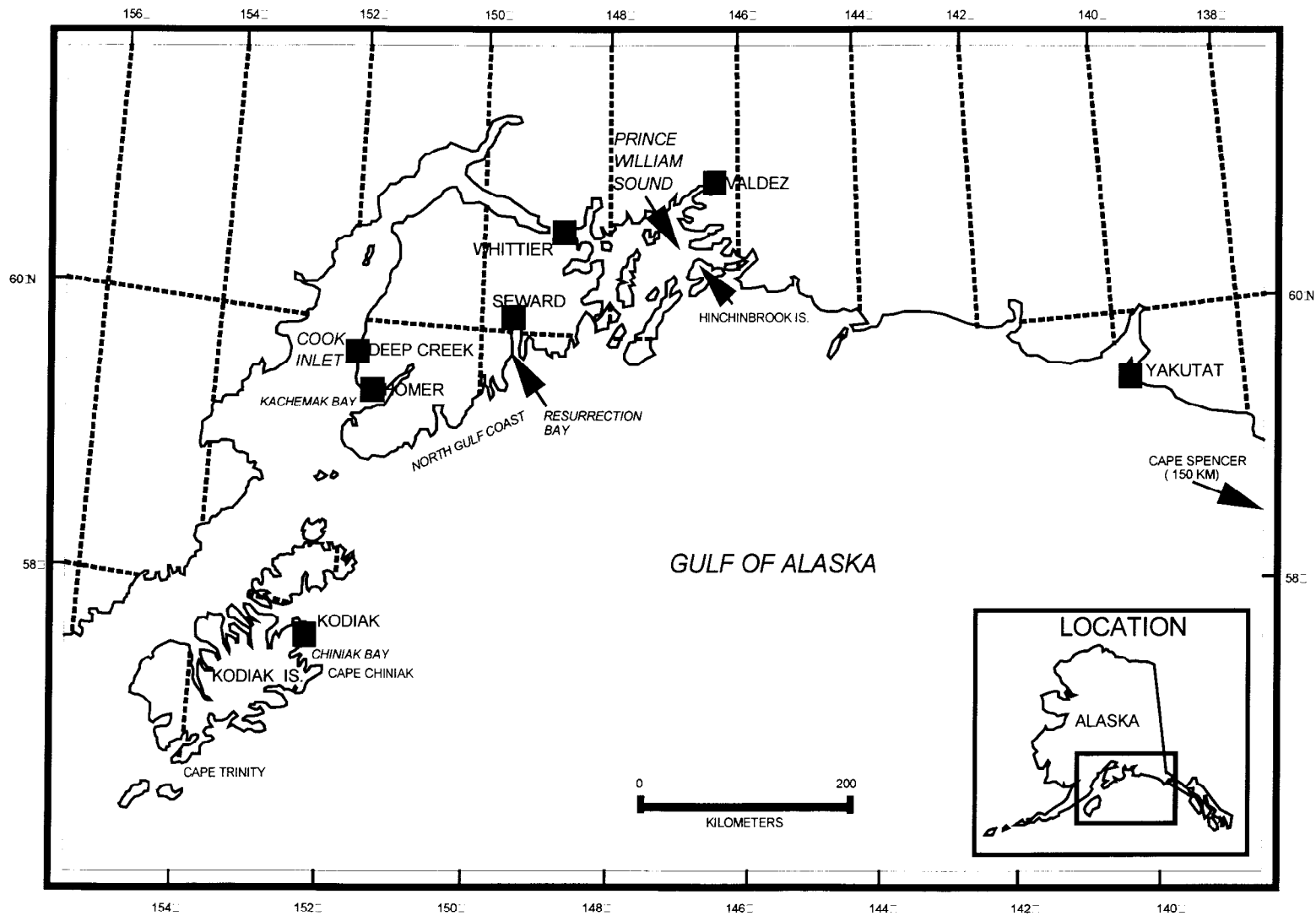


Figure 9.-North Gulf of Alaska coastal waters and major ports of recreational halibut landings in IPHC Regulatory Area 3A.

however, is distributed outside of Resurrection Bay between the Chiswell Islands and Cape Puget. A net redistribution of effort outward from Seward has occurred in the last 20 years (Meyer 1992).

Harvest in the North Gulf Coast fishery rose from 1,700 fish in 1977 to 25,500 fish in 1993 (Table 5). Since 1993, harvest in this fishery has remained relatively stable. The reason for the stable harvest may be that the market in Seward is becoming saturated. The proportion of the harvest by chartered anglers has generally increased since 1986 (Figure 10).

Although the Seward harbor is overcrowded and has a long waiting list for slips, some future growth of the fishery may occur. Seward is only a 2-hour drive from Anchorage, and the City of Seward is currently planning construction of an additional launching ramp.

Table 8.-Number of halibut harvested in Cook Inlet recreational fisheries, 1977-1996.

Year	Lower Cook Inlet	Central Cook Inlet	West Cook Inlet ^a	Total Cook Inlet	Percent of Area 3A
1977	9,416	4,050	-	13,466	75.5
1978	20,756	4,821	-	25,577	82.6
1979	20,479	6,518	-	26,997	77.8
1980	21,808	8,177	-	29,985	75.3
1981	29,294	9,427	-	38,721	75.1
1982	28,851	10,681	-	39,532	72.1
1983	36,623	23,503	-	60,126	79.7
1984	37,747	23,455	-	61,202	79.2
1985	41,450	21,198	510	63,158	77.5
1986	44,250	39,831	1,072	85,153	73.6
1987	45,707	31,855	869	78,431	77.6
1988	93,878	42,182	1,192	137,252	81.6
1989	76,606	49,087	1,224	126,917	82.4
1990	93,941	52,912	1,685	148,538	82.8
1991	89,998	57,072	1,576	148,646	78.5
1992	81,451	60,659	984	143,094	74.4
1993	159,906 ^b		2,507	162,413	72.3
1994	89,208	81,593	^c	170,801	71.8
1995	86,352	81,802	^c	168,154	72.2
1996	107,704	84,962	^c	192,666	75.0

^a No halibut harvest was recorded in West Cook Inlet until 1985.

^b Cannot distinguish between Lower and Central Cook Inlet.

^c Built into Lower and Upper Cook Inlet harvests.

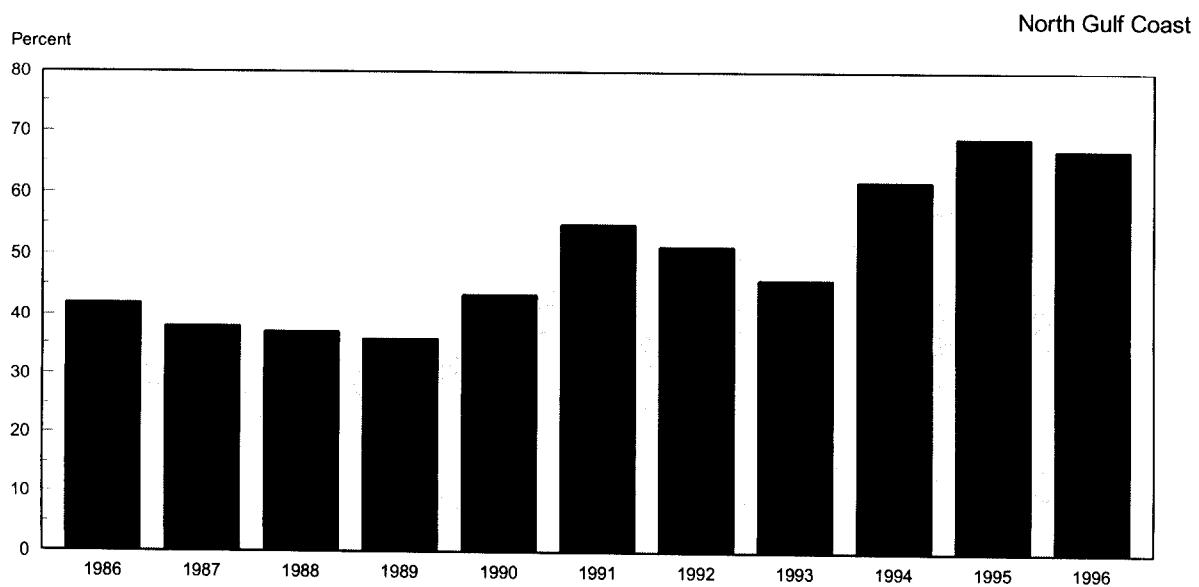
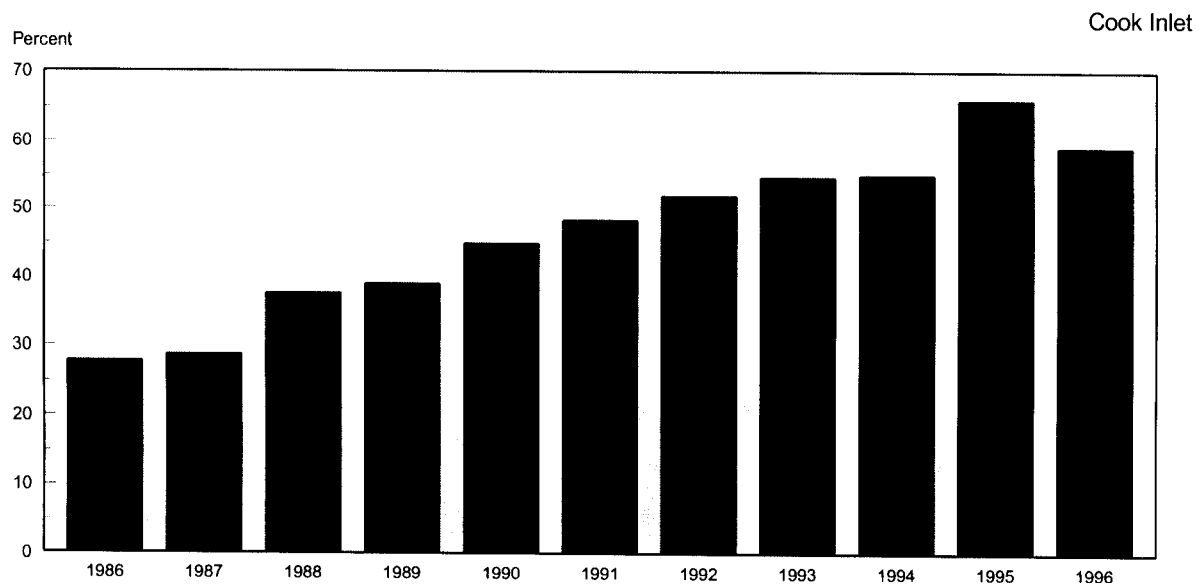


Figure 10.-Percentage of the total recreational halibut harvests by chartered anglers in Kenai Peninsula fisheries, 1986-1996.

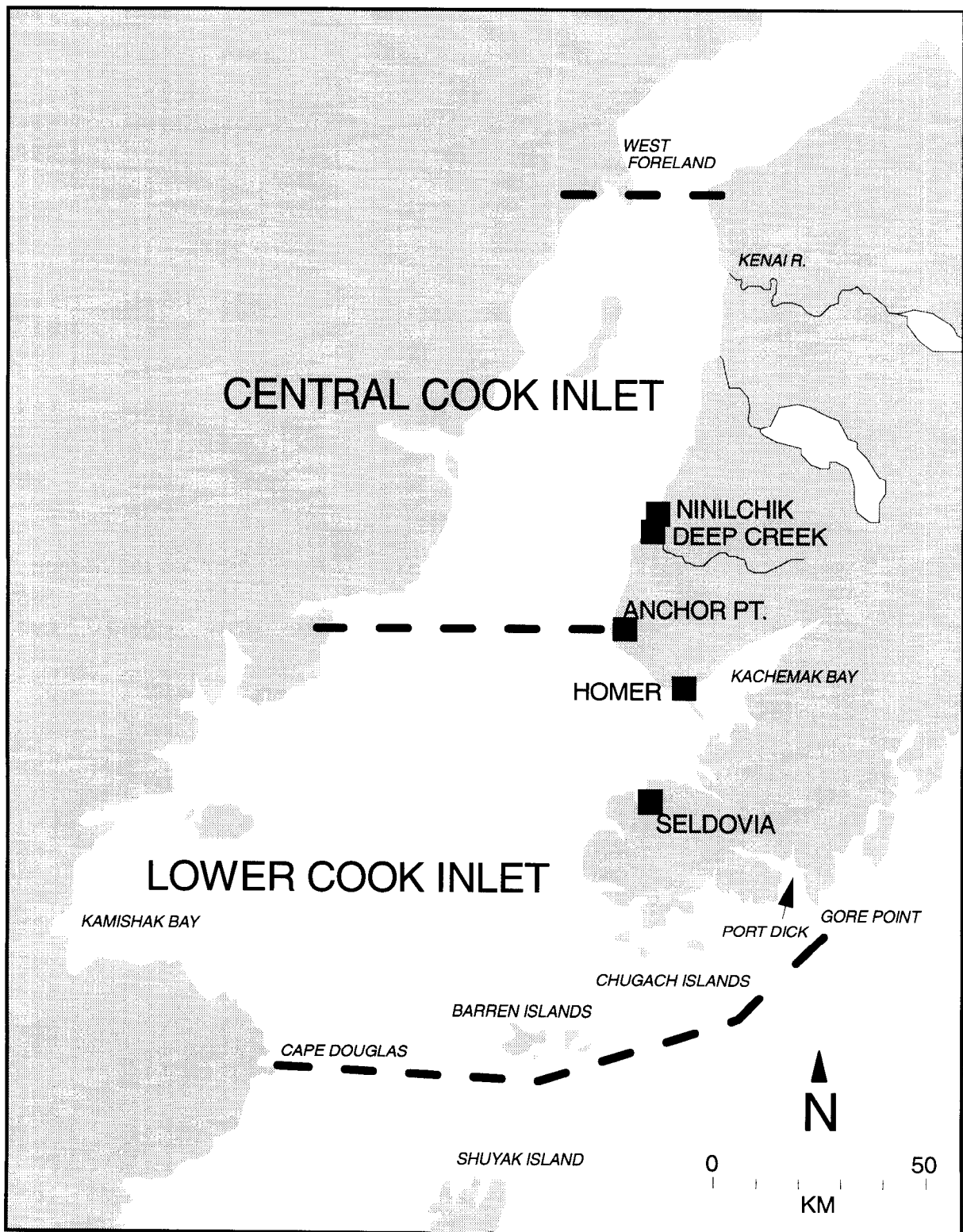


Figure 11.-Approximate areas fished in the Central and Lower Cook Inlet recreational halibut fisheries.

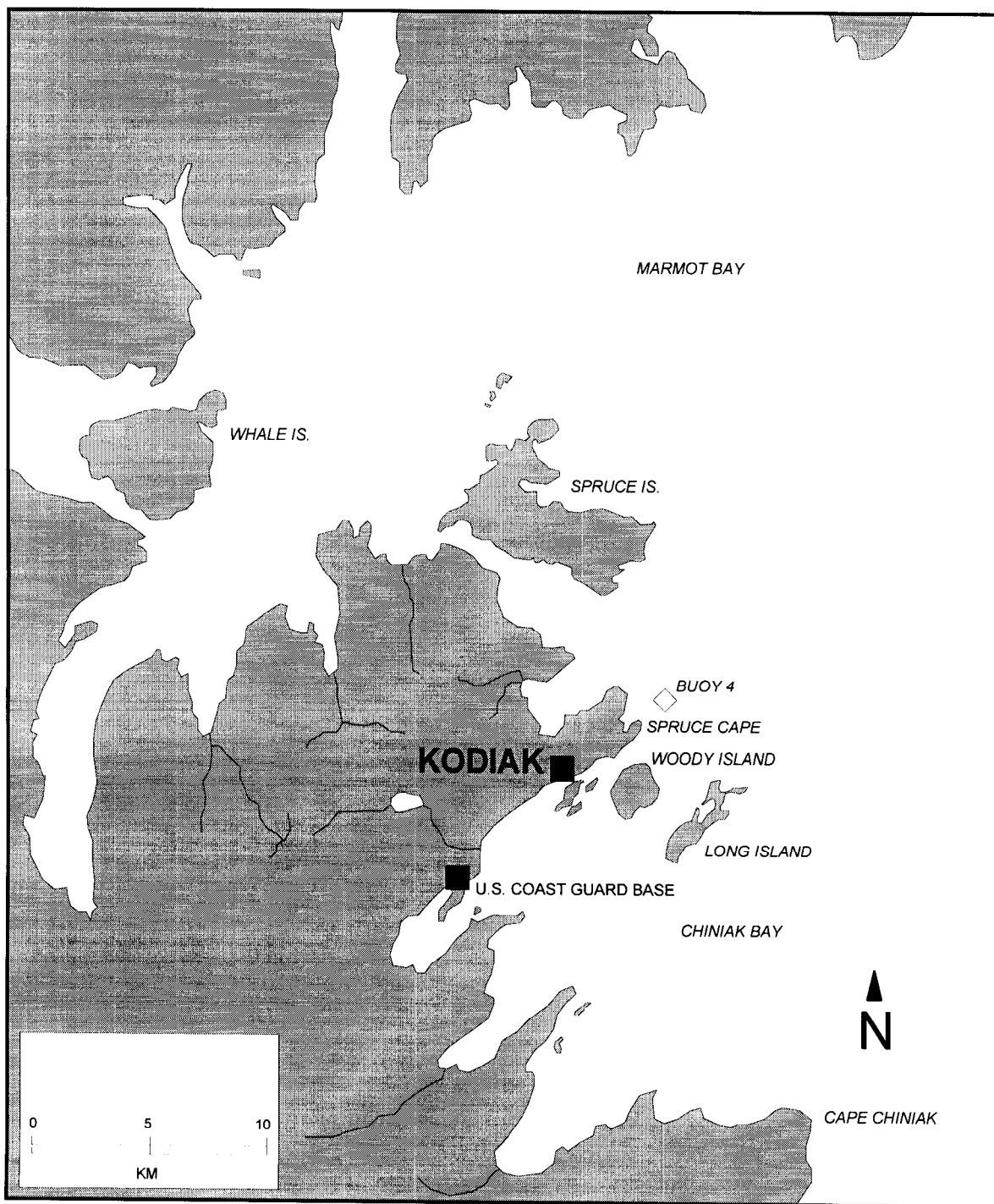


Figure 12.-Approximate waters fished by the Kodiak-based recreational halibut fleet.

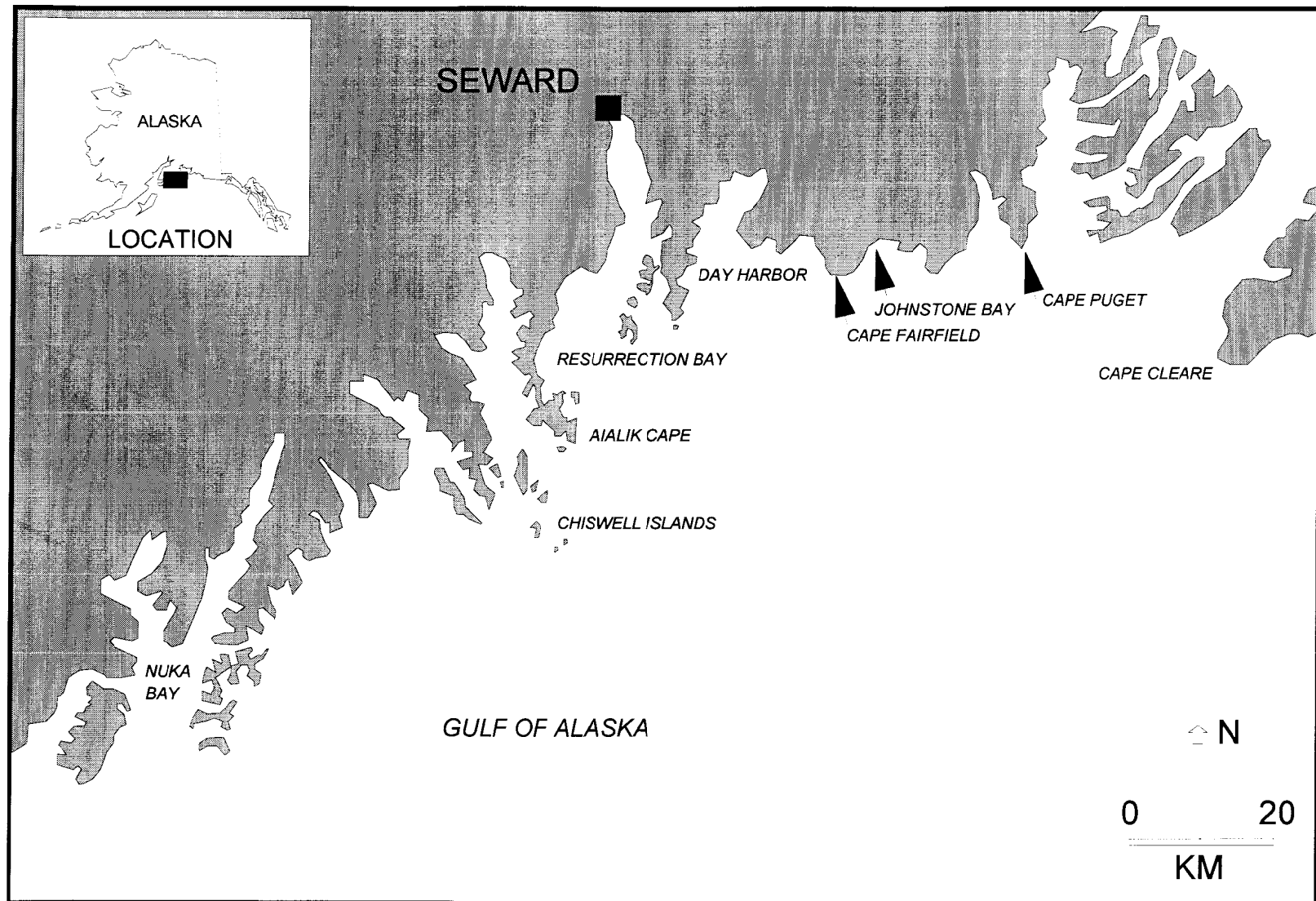


Figure 13.-Approximate waters fished along the North Gulf Coast by the Seward-based recreational halibut fleet.

Prince William Sound

Halibut harvest in Prince William Sound (Figure 14) grew from 1,200 fish in 1977 to 24,800 fish in 1995 (Table 5). The 1996 harvest of 22,900 halibut indicates the period of growth in this fishery may have ended and harvest may have begun to stabilize. As is the case in Seward, the stabilization of harvest may be due to the market in Valdez becoming saturated.

The majority of the Prince William Sound recreational halibut harvest is from boats based in Valdez. Valdez currently supports an active civilian charter fleet of about 15-25 boats, and a military charter fleet of seven boats. Although Whittier is close to Anchorage and supports high recreational boating use, most Whittier boaters do not fish for halibut, and the harvest is a small percentage of the total for the sound (Mills 1979-1994, Meyer 1992). Likewise, Cordova supports a large and active commercial fleet, but there has been relatively little interest in recreational halibut fishing.

Valdez-based boats generally fish a north-south corridor between Valdez Arm and Hinchinbrook Entrance, on the eastern side of the sound (Meyer 1992, 1994). Popular sites include Bligh Reef, Knowles Head, Hinchinbrook Entrance, and Seal Rocks (Figure 14). Few private boats from Valdez fish sites south of Knowles Head where generally only charter boats are equipped to handle the rougher water often encountered. In contrast, Whittier-based boats concentrate bottom fishing effort in the northwestern corner of Prince William Sound, in Passage Canal, Blackstone Bay, and in waters near Esther and Perry islands.

Regulatory Area 3B

Few recreational anglers fish halibut in Area 3B waters, and as a result reliable estimates of recreational angler effort or halibut harvest are unavailable for these waters from the mail survey. The department believes that less than 2,500 angler-days are expended and less than 1,000 halibut are taken annually from these waters in total. Most of the effort and harvest occurs in the vicinity of Cold Bay and Unalaska. Significant increases in effort and harvest are not expected in the near future in this area given its remoteness.

Commercial harvests, bycatch, and wastage vastly outnumber sport removals in this regulatory area. Of the 5.72 million pounds of halibut removed from Area 3B waters during 1996, only 18,000 pounds were harvested by recreational anglers (IPHC 1997).

Regulatory Area 4

As with Area 3B, few recreational anglers fish halibut in Area 4 waters, and as a result reliable estimates of recreational angler effort or halibut harvest are unavailable for these waters from the postal survey. The department believes that less than 3,000 angler-days and less than 4,000 halibut are taken from these waters in total. Most of this effort and harvest occurs in the vicinity of Adak and Unalaska. However, the Adak Naval Base has closed and as a result angling effort for all species dropped significantly (Schwarz 1996). Recreational halibut harvest in this area is expected to decline significantly in the immediate future. Future growth in the Unalaska halibut fishery can be expected.

Commercial harvests, bycatch, and wastage vastly outnumber sport removals in this regulatory area. Of the 13.70 million pounds of halibut removed from Area 3B waters during 1996, only 45,000 pounds were harvested by recreational anglers (IPHC 1997).

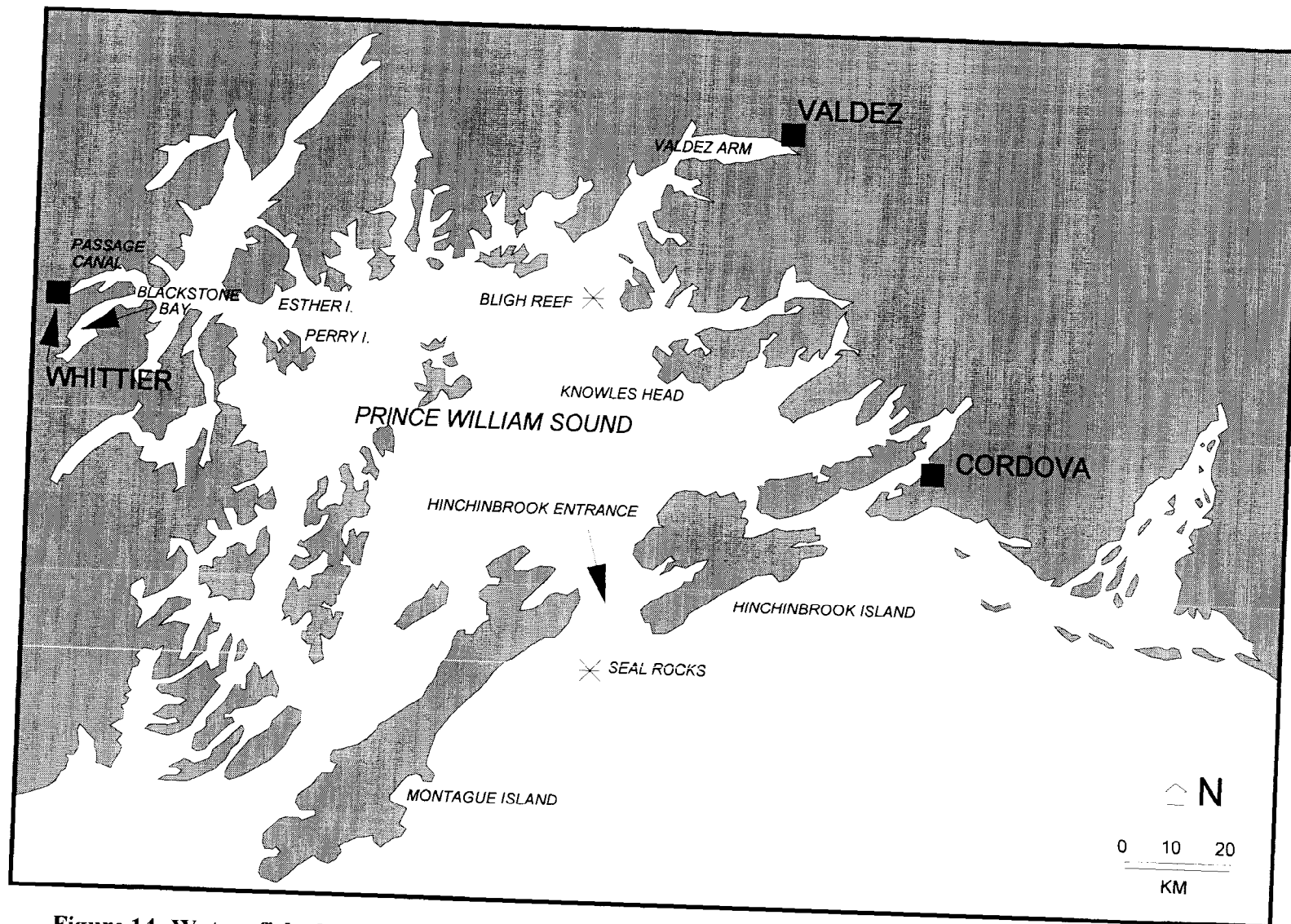


Figure 14.-Waters fished by recreational halibut fleets based out of Whittier, Valdez, and Cordova.

Management Issues

The NPFMC took three actions at their September 1997 meeting affecting charter boats fishing halibut off Alaska. First, the NPFMC adopted a guideline harvest limit (GHL) for charter boat operators, lodges, and outfitters who fish for halibut in halibut regulatory areas 3A (southcentral) and 2C (southeast). These limits were set at 125% of the percent of the combined commercial setline and guided sport harvest TAC in 1995. This translates to a GHL of 12.76% and 15.61% of the combined commercial and guided sport halibut TAC in Areas 2C and 3A, respectively. As such, the GHL is not a fixed number, rather a “cap” that floats with future TACs. No GHLs were set for areas west of Area 3A. The NPFMC further recommended that the GHLs not be used as inseason triggers, rather as gauges to trigger the adoption of preseason management actions tailored to constrain future fisheries which may exceed a GHL. The NPFMC did not identify components of the management plan that could be used to constrain the fishery. They did specify, however, that the plan should maintain a stable charter season of historic length, using statewide and zone-specific measures. The NPFMC recommended that the components of the management plan be developed in cooperation with the ABOF and regional charter boat industry representatives. The NPFMC has formed a committee to develop components of the management plan that is practical and workable to assure the GHLs are not exceeded. Once these components are developed, the NPFMC will review them and the GHLs and decide whether to forward them onto the Secretary of Commerce for approval.

Second, the NPFMC endorsed using the NPFMC/ABOF partnership to facilitate the development of local area plans and asked that the ABOF take the lead in this process. The development of the local area management plans was universally supported and, depending upon the framework developed, should be useful towards resolving user conflicts and addressing the issue of local depletion in the marine waters adjacent to coastal communities around Alaska. The ABOF discussed this topic at their September 1997 work session and decided to issue calls for proposals towards developing these plans as they come up during their regular meeting cycle. Under this approach, Cook Inlet, Lower Cook Inlet, and Kodiak are up for consideration during the 1998/99 cycle; Prince William Sound and southeast Alaska during the 1999/2000 cycle; and the Alaska Peninsula during the 2000/01 cycle. A variety of measures, including moratoriums, harvest caps, and/or exclusion zones for all fisheries, could be implemented as part of a local plan. Aspects of these plans affecting halibut will need NPFMC approval prior to their implementation. Currently, a local area management plan for Sitka is being developed and will be discussed by the NPFMC in February 1998.

Third, the NPFMC recommended implementing record keeping and reporting requirements for charter boat operators, lodges, and outfitters who fish for halibut. The NPFMC recommended that this requirement be developed through the ABOF and be gathered by the ADF&G. The NPFMC requested that the reports include catch figures, locations of catch, number of clients, residence information of clients, ownership of vessels, and identity of operators. The ABOF agreed to consider implementing reporting requirements, and is scheduled to discuss these requirements at their February statewide finfish meeting. The record keeping and reporting requirement was universally supported and, if proprietary information about clients is kept confidential, should not represent an adverse impact on the industry. In anticipation of the adoption of reporting requirements, the department will implement a statewide logbook program for marine charters in 1998.

For a variety of reasons, the department, the NMFS, members of the ABOF present at the September meeting, the charter boat industry, recreational fishing representatives, and sportsman groups did not support the establishment of GHGs. As a result, several issues have been raised regarding this action. First and foremost, the validity of data used to establish the GHG is being questioned. Second, the undefined nature of the management options to be employed in the event the GHG is achieved is an issue. The selection of these measures is critical in determining the type and magnitude of potential impacts to the charter boat industry and sport anglers who employ them. The operators predict their ability to attract clients would be diminished if bag limits were reduced or size limits were enacted. If data on which projections are based are reasonably correct, it appears unlikely that the GHG will constrain the charter industry for 3 to 6 years. However, because the GHGs are tied to future TACs, it is possible for the GHGs to be constraining in a shorter period of time. The implications of an earlier-than-expected achievement of the GHG was not fully discussed or planned for. However, because halibut biomass is projected to increase over the next several years, it is not anticipated that the GHGs will be exceeded in the next couple of years.

There are options that the NPFMC did not include in their September action. These were a moratorium, limited entry licenses, or IFQs. The deferral of these approaches is clearly in recognition of the fact that the information needed to determine active participation at an individual operator or firm level was lacking. They rescheduled visiting these options in October of the year 2000.

Much concern has been expressed about the NPFMC process and lack of representation for sport interests. While it is true that the NPFMC has no specific seat which represents sport fishing interests, the NPFMC does have an advisory panel (AP) which includes a representative for the sport fishing constituency as well as a representative for the guided halibut charter industry. As the NPFMC begins to take up more issues relating to and impacting Alaskan sport fisheries, consideration of appointments will need to include persons familiar with sport fishing issues.

Another issue regards possible resource competition between sport charter and commercial fishermen. Charter boat operators are concerned that commercial longliners fishing under an IFQ program implemented in 1995 could deplete nearshore halibut stocks currently targeted by charter boat anglers and "crowd" recreational fishermen off their traditional recreational fishing grounds. Based on discussions with several charter boat associations throughout southcentral Alaska, some conflict between user groups occurred during the 1995 fishery. To alleviate this problem, charter boat operators have suggested that the NPFMC consider establishing exclusive recreational fishing zones in their traditional fishing grounds, where commercial longlining would be prohibited. As can be expected, this type of proposal has not been well received by commercial fishermen. Local area management planning should go a long ways towards resolving such conflicts.

Lastly, the possibility that there may be many smaller discrete stocks of halibut within regulatory areas has been raised. This is contrary to the past theory that there is one large stock with most of the recruitment occurring in the Bering Sea and migrating down the coast. This raises the possibility of localized overfishing within a regulatory area, especially in areas near major ports where sport and commercial fishing effort may be high.

Management History

The ABOF does not have direct management authority over halibut in Alaska. The ABOF has, however, for enforcement reasons, enacted regulations consistent with those enacted by the IPHC or NPFMC. In 1981, the ABOF adopted a 2 fish daily and in possession regulation for all state waters. In 1988, this regulation was changed to permit 4 fish in possession, the daily bag limit was not changed.

Ongoing Research and Management Activities

A research program to evaluate the age, sex, and size compositions of the recreational halibut harvests from Area 3A waters began during 1994. Area 3A ports currently being sampled include Valdez and Seward in the North Gulf of Alaska and Kodiak and Homer. Secondary objectives of the study are to provide fishery managers with information regarding characteristics of the fishing fleet operating out of study ports. We recommend this research be continued for the immediate future.

Information provided by ADF&G is needed for management of the fishery. Historically, only commercial removals were used to estimate exploitable biomass because other removals such as sport harvest were considered negligible. Recently, the IPHC has attempted to account for all sources of removal, including sport, subsistence, bycatch, and wastage. Incorporation of sport harvest in the 1991 stock assessment led to a 10% to 15% increase in overall harvest and a 10% increase in estimated biomass over recent years (Sullivan et al. 1992). Age composition of the sport harvest will be incorporated into catch-at-age analyses to estimate exploitable biomass after more years of data become available. Estimates of the mean weight of fish taken in the sport fishery are used to obtain the harvest in pounds. Information on length and sex composition can be used to evaluate the effects of traditional management measures, such as size limits. Tallies of harvest per boat trip are used to evaluate the effects of changes in bag limits. Finally, knowledge of areas fished may be useful in evaluating competition on the fishing grounds and localized stock depletion.

The Division of Sport Fish is instituting a logbook reporting system for all charters operating in marine waters off Alaska in 1998. Data to be collected with this program include catch figures, locations of catch, number of clients, residence information of clients, ownership of vessels, and identity of operators. No proprietary information about clients will be collected. Information collected as part of this program should be useful to aid decisions regarding management and allocation of North Gulf of Alaska halibut resources.

NORTH GULF OF ALASKA RECREATIONAL ROCKFISH FISHERIES

A variety of rockfishes inhabit the marine waters of the North Gulf of Alaska, including species of the genera *Sebastes* and *Sebastolobus*. For management purposes, these rockfishes are usually categorized into the following groups: slope rockfish, demersal shelf rockfish, and pelagic shelf rockfish (Table 9). The recreational fishery primarily targets the demersal shelf and pelagic shelf rockfish groups, with slope rockfish only occasionally being harvested. Although many species of rockfish have been identified as being harvested by recreational anglers fishing in the North Gulf of Alaska (Meyer 1993a), the most commonly harvested rockfish in the recreational fishery are the demersal shelf yelloweye rockfish *Sebastes ruberrimus* and the pelagic shelf black *S. melanops* and dusky *S. ciliatus* rockfishes.

Table 9.-Species comprising the slope, pelagic shelf, and demersal shelf rockfish assemblages.

Species Assemblage	Common Name	Scientific Name
Pelagic Shelf	Dusky rockfish	<i>Sebastes ciliatus</i>
	Black rockfish	<i>Sebastes melanops</i>
	Widow rockfish	<i>Sebastes entomelas</i>
	Blue rockfish	<i>Sebastes mystinus</i>
	Yellowtail rockfish	<i>Sebastes flavidus</i>
Demersal Shelf	Canary rockfish	<i>Sebastes pinniger</i>
	China rockfish	<i>Sebastes nebulosus</i>
	Copper rockfish	<i>Sebastes caurinus</i>
	Quillback rockfish	<i>Sebastes maliger</i>
	Redbanded rockfish	<i>Sebastes babcocki</i>
	Rosethorn rockfish	<i>Sebastes helvomaculatus</i>
	Tiger rockfish	<i>Sebastes nigrocinctus</i>
	Yelloweye rockfish	<i>Sebastes ruberrimus</i>
Slope	Pacific Ocean perch	<i>Sebastes alutus</i>
	Shortraker rockfish	<i>Sebastes borealis</i>
	Rougheye rockfish	<i>Sebastes aleutianus</i>
	Northern rockfish	<i>Sebastes polyspinis</i>
	Sharpchin rockfish	<i>Sebastes zacentrus</i>
	Redstripe rockfish	<i>Sebastes proriger</i>
	Harlequin rockfish	<i>Sebastes variegatus</i>
	Silvergrey rockfish	<i>Sebastes brevispinis</i>
	Yellowmouth rockfish	<i>Sebastes reedi</i>
	Bocaccio	<i>Sebastes paucispinis</i>
	Greenstriped rockfish	<i>Sebastes elongatus</i>
	Darkblotched rockfish	<i>Sebastes crameri</i>
	Pygmy rockfish	<i>Sebastes wilsoni</i>
	Splitnose rockfish	<i>Sebastes diploproa</i>
	Aurora rockfish	<i>Sebastes aurora</i>
	Blackgill rockfish	<i>Sebastes melanostomus</i>
	Chilipepper rockfish	<i>Sebastes goodei</i>
	Shortbelly rockfish	<i>Sebastes jordani</i>
	Stripetail rockfish	<i>Sebastes saxicola</i>
	Vermilion rockfish	<i>Sebastes miniatus</i>

From: NPFMC 1993

The recreational fishery for rockfish in the North Gulf of Alaska occurs primarily in state waters. In state waters, responsibility for management and allocation of rockfish lies with the ABOF. Under ABOF-adopted regulations, there are no size restrictions for rockfish in any of the North Gulf of Alaska regulatory areas, and limits for rockfish in the North Gulf of Alaska vary by regulatory area. In Prince William Sound the limits are 5 per day, 10 in possession from May through September; and 10 per day 10 in possession from September 16 through April 30; of which no more than 2 rockfish per day and 2 in possession may be nonpelagic rockfish. There is also a requirement that all rockfish which are removed from the water in PWS must be retained as part of the bag limit of the person originally hooking them. In the Cook Inlet-Resurrection Bay Saltwater Area, the limits are 5 per day, 10 in possession year-round of which no more than 1 daily and 2 in possession may be nonpelagic rockfish. In the Kodiak and Alaska Peninsula-Aleutian Islands Regulatory Area, the limits are 10 per day, 20 in possession year-round. Although available and open year-round, most recreational rockfish are harvested from May through early September.

The commercial fishery for rockfish in the North Gulf of Alaska occurs both in state and federal waters. In state waters, the ABOF has allocative and management responsibility for rockfish. Up until 1993, the Commercial Fisheries Management and Development Division lacked specific strategies for the management of rockfishes in state waters and thus management was consistent with adjacent federal waters via the NPFMC management plans (Bechtol 1992). These management plans, based on a management strategy for slope rockfishes appeared insufficient for conservation of nearshore rockfish assemblages, which are dominated by pelagic and demersal shelf rockfishes. For this reason, the ABOF adopted the North Gulf of Alaska Rockfish Management Plan, which uses trip and bycatch limits and annual harvest guidelines to better protect nearshore rockfish assemblages. The plan became effective during 1993 and was a good first step towards management of this fishery.

The NPFMC has a Plan Team which addresses, among other items, stock assessment and management of rockfish. The state is increasing its involvement in this process as it takes a more active role in the management of rockfish species in state waters. Division of Sport Fish may be interested in gaining a seat on the Plan Team in the future.

Management Objective and Approach

Rockfish stocks of the North Gulf of Alaska are managed for both commercial and recreational uses. In most years, commercial harvests have exceeded sport harvests in most areas of the North Gulf of Alaska. However, in some areas, notably along the North Gulf of Alaska near Seward, recreational harvests in some years exceed commercial harvests. At present, there are no major allocation issues surrounding North Gulf of Alaska rockfish stocks.

Due to a lack of stock assessment data, no specific fishery objectives have been formally established for recreational rockfish fisheries of the North Gulf of Alaska. An assumption of past and current fisheries management has been to assure the sustained yield of the various rockfish stocks that occur within the area, while assuring continued and, where possible, expanded opportunity to participate in diverse fisheries targeting these stocks. Given the lack of data, recreational fisheries targeting North Gulf of Alaska rockfish stocks are managed under relatively restrictive regulations.

Stock Status

Unfortunately, there is a lack of historic data to assess either the sustained yields or current status of North Gulf of Alaska rockfish stocks. Thus, we do not know at present whether current harvest levels are sustainable. However, based on known life history characteristics, it appears that some demersal shelf rockfish, specifically yelloweye rockfish in the vicinity of Seward, are being overharvested. Pelagic shelf black and dusky rockfishes may also be overharvested. To reduce harvest on demersal-shelf stocks, the ABOF has recently adopted (at the department's request) reduced bag and possession limits for these species.

Fisheries Overview

North Gulf of Alaska rockfish assemblages support popular and diverse recreational fisheries, which in 1996 supported about 38,000 days of angling effort (Table 1). In comparison, these fisheries supported 19,000 days of recreational angling effort in 1987. Major recreational rockfish fisheries occur out of Valdez, Whittier, and Cordova in Prince William Sound; Seward along the North Gulf of Alaska; Homer in Lower Cook Inlet; and Kodiak on the Kodiak Island Archipelago. Of these, the most popular fisheries in terms of effort and harvest are those that occur out of Seward along the North Gulf of Alaska.

Although accessible by road, all North Gulf of Alaska rockfish fisheries are considered remote because participation requires a boat or a guide. Thus, the cost to participate in these fisheries is relatively high. Guided anglers make up a significant component of the North Gulf of Alaska rockfish fishery. Because of the availability of guides, these fisheries offer a range of angling opportunities for both experienced and inexperienced anglers. Information is not available to estimate the economic value of the North Gulf of Alaska recreational rockfish fishery.

The sport harvest of rockfish from North Gulf of Alaska waters has generally been stable since 1989 (Table 10, Figure 15). Assuming an average round weight of 4.8 pounds per harvested rockfish, the 1996 harvest amounts to a harvest of 225,000 pounds, which is about the average harvest for the period 1989-1996 (Table 10). North Gulf Coast waters accessible from Seward have accounted for a majority of the total rockfish harvest in all years (Table 10). The Seward area rockfish fishery is one of the largest recreational rockfish fisheries in Alaska (Mills 1991). Areas fished near Seward include waters from the entrances to Prince William Sound to Gore Point; however, most of the fishery occurs in the vicinity of the capes and islands near the entrance to Resurrection Bay.

In addition to the harvest of 46,930 rockfish from North Gulf of Alaska waters during 1996, 39,190 rockfish were estimated to have been caught and released by sport anglers (Table 11). In general, the number of rockfish released by recreational anglers has been stable (Figure 16). Mortality of released rockfish, most notably the demersal shelf rockfishes, is believed to be high.

North Gulf of Alaska rockfish stocks are also harvested in several commercial fisheries. In the Central Region (extending from PWS eastward through Cook Inlet), commercial harvests have exceeded recreational harvests 5 of the last 6 years (Table 12).

Management Issues

There has been a great deal of concern voiced by federal and state managers over the past decade regarding the status of North Pacific rockfish stocks and the validity of current practices and approaches used to manage these stocks. Specifically, managers are concerned that many

Table 10.-Harvest of rockfish, by area, by recreational anglers fishing North Gulf of Alaska waters, 1977-1996.

Year	Prince William	North Gulf	Kodiak	Alaska Peninsula	Cook	Total	
	Sound	Coast		Aleutian Islands	Inlet	Number	Pounds ^a
1977	4,401	13,021	2,810	0	1,860	22,092	106,042
1978	5,035	18,087	1,907	0	4,332	29,361	140,933
1979	11,018	22,281	3,599	0	2,989	39,887	191,458
1980	6,174	27,967	1,489	0	1,995	37,625	180,600
1981	11,610	19,526	6,242	421	3,575	41,374	198,595
1982	5,608	23,032	3,992	178	2,473	35,283	169,358
1983	6,514	18,339	3,252	62	4,361	32,528	156,134
1984	7,993	22,882	8,231	1,116	3,603	43,825	210,360
1985	8,853	17,105	4,691	199	2,723	33,571	161,141
1986	9,762	38,660	4,479	686	6,103	59,690	286,512
1987	6,563	12,768	6,501	2,046	3,386	31,264	150,067
1988	12,711	35,688	11,369	1,875	9,639	71,282	342,154
1989	12,919	24,888	5,070	255	4,140	47,272	226,906
1990	8,157	18,729	3,842	2,677	3,208	36,613	175,742
1991	8,733	19,803	8,036	1,044	2,819	40,435	194,088
1992	15,478	28,729	5,652	914	4,537	55,310	265,488
1993	12,274	24,978	7,569	781	4,993	50,595	242,856
1994	15,382	28,256	5,019	724	5,184	54,565	261,912
1995	14,701	17,360	4,247	559	4,399	41,266	198,077
1996	13,788	22,075	6,207	534	4,326	46,930	225,264

^a Assumes an average weight of 4.8 pounds for 1977-1990; weights for 1991-1996 from port sampling data located at ADF&G, Homer.

rockfish stocks, specifically demersal shelf rockfishes, in the North Pacific Ocean are being overharvested, and that current management strategies are not protecting rockfish stocks from overharvest and are not allowing depressed stocks to rebuild.

Historically, rockfish have been managed based on sustained yield principles using yield or production models based on relatively short-lived and fast-cycling species (less than 15 years). The validity of applying these models to longer-lived species like rockfish, which exhibit extreme longevity, is questionable, especially given the documented declines in many rockfish stocks over the past decade. Also, due to a lack of species-specific life history information for many rockfish species, rockfish are often grouped into species assemblages, which are managed based on assumed or average life history characteristics of the species assemblage. This often leads to more susceptible species in an assemblage being overexploited at the cost of harvesting the less susceptible species in that assemblage.

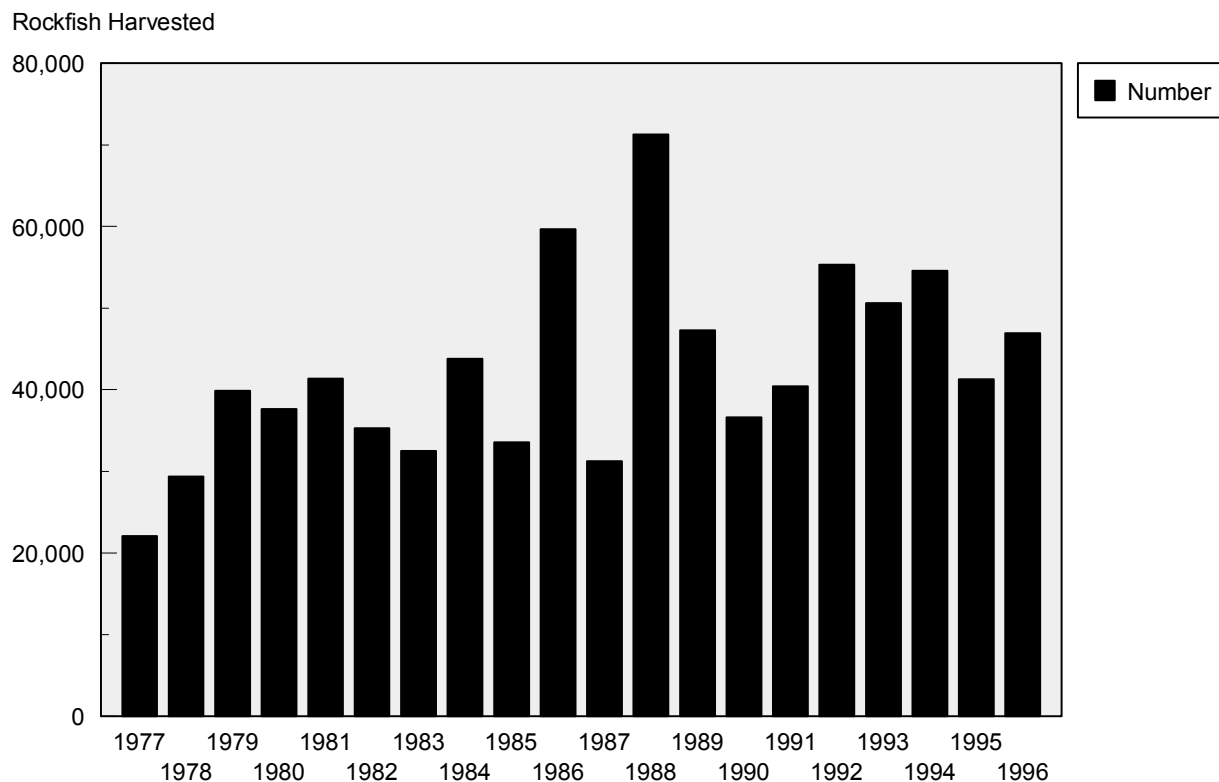


Figure 15.-Harvests of rockfish by recreational anglers fishing North Gulf of Alaska waters, 1977-1996.

Table 11.-Number of rockfish released, by area, by recreational anglers fishing North Gulf of Alaska waters, 1990-1996.

Year	Prince William Sound	North Gulf Coast		Alaska Peninsula		Cook Inlet	Total
			Kodiak	Aleutian Islands			
1990	10,263	13,276	5,064	3,371	7,240		39,214
1991	4,464	7,751	3,020	1,718	2,744		19,697
1992	6,643	11,055	7,384	1,540	9,654		36,276
1993	6,680	15,027	7,985	3,816	12,132		45,640
1994	9,924	20,461	5,965	685	3,207		40,242
1995	9,563	8,208	4,112	932	7,572		30,387
1996	9,687	11,324	6,779	1,972	9,428		39,190

Source: Mills 1991-1994, Howe et al. 1995-1997.

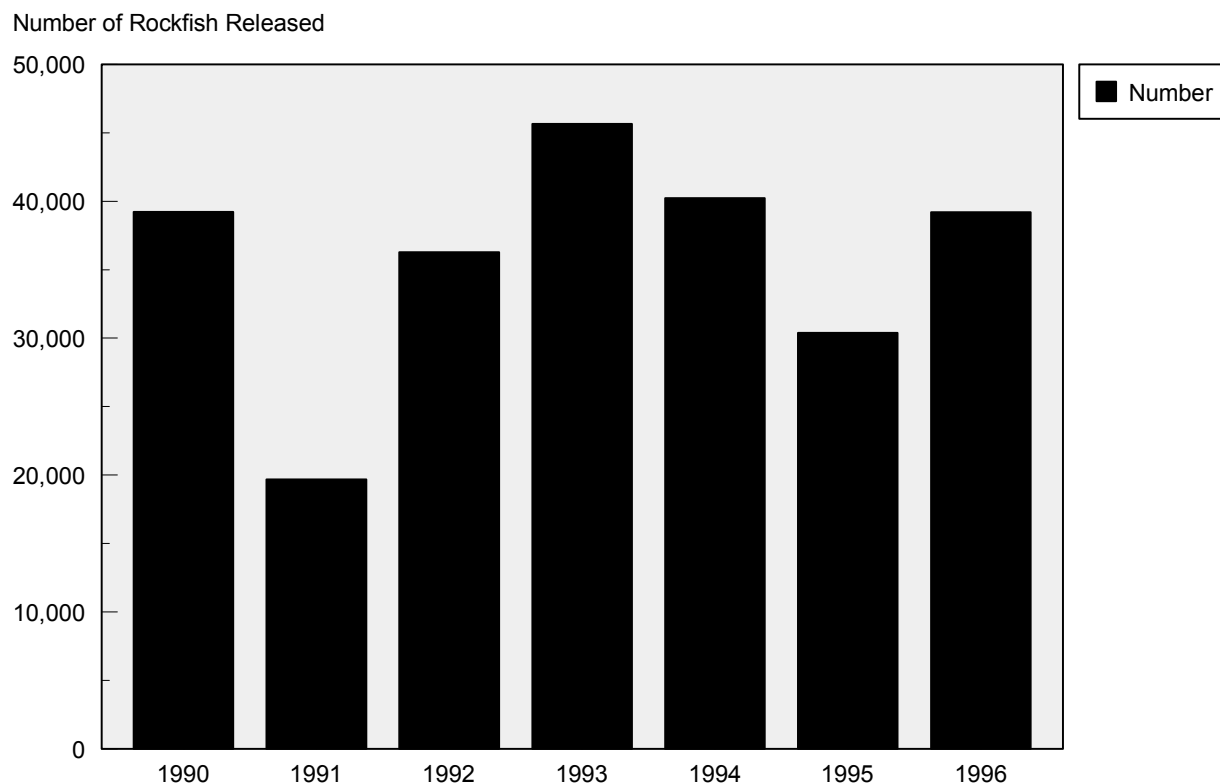


Figure 16.-Number of rockfish released by recreational anglers fishing North Gulf of Alaska waters, 1990-1996.

Table 12.-Comparison of recreational and commercial harvests of rockfish (pounds, round weight) in the North Gulf of Alaska, 1991-1996.

Year	Recreational		Commercial		Total
	Pounds	Percent	Pounds	Percent	
1991	155,687	29	376,235	71	531,922
1992	226,500	30	530,495	70	756,995
1993	208,482	57	159,039	43	367,521
1994	235,123	42	319,130	58	554,253
1995	192,239	29	460,749	79	652,988
1996	192,907	44	245,747	56	438,654

Note: Excludes Kodiak and the Alaska Peninsula/Aleutian Islands area harvests.

Much of the concern for rockfish arises from the inherent susceptibility of rockfishes to overexploitation. Rockfish tend to be slow-growing and long-lived. Many rockfish do not mature until at least 10 years of age, with some rockfish not maturing until age 20. Most rockfish live more than 50 years; some rockfish can live to over 100 years. Rockfish also display high natural survival rates. Most rockfish have annual survival rates exceeding 80%, with some rockfish having rates exceeding 95%. Lastly, juvenile survival is often at the mercy of marine environmental conditions. Given these life history characteristics, many rockfish have very low sustained yields. For some species, the acceptable fishing mortalities may be limited to bycatch mortality only, given that survival of released rockfish is low. Additionally, there is a lack of species-specific life history information for many rockfish species and an inability to obtain accurate biomass or abundance estimates for many rockfish species.

Commercial and recreational landings of rockfish have increased over the past decade as many traditional fisheries, such as salmon and crab, have experienced biological or economic declines. Stock composition data to assess the North Gulf of Alaska rockfish resources are limited. Efforts to control harvest levels and protect the rockfish resources of this area have involved adopting increasingly restrictive regulations for recreational fisheries, and federal management strategies and inseason closures for commercial fisheries. However, this approach has not offered sufficient protection to some heavily exploited nearshore stocks. Limited data from commercial test fishing and sport fishing in marine waters in and near Resurrection Bay suggest that the abundance of older black rockfish has declined since the early 1980s and that some species such as yelloweye rockfish are disappearing (Vincent-Lang 1991).

In past years, the ABOF has promulgated regulations that have increasingly restricted the bag and possession limits for recreational anglers along the North Gulf coast in an attempt to maintain the sustained yield of these stocks. Harvests have stabilized under the more restrictive regulations, however the specter of stock conservation concerns remains as local areas near major ports become “fished out.”

During their 1992 meeting, the ABOF established a series of management plans for Central Gulf of Alaska commercial rockfish fisheries. These management plans (North Gulf Coast 5 AAC 28.465, Prince William Sound 5 AAC 28.265, and Cook Inlet 5 AAC 28.365) establish trip limits for allowable rockfish landings during a 5-day period for the North Gulf Coast, Prince William Sound, and Cook Inlet areas. The plans also establish harvest quotas for each area (150,000 pounds) after which the fishery in an area reverts to bycatch only. It is hoped this action will bring harvest rates to sustainable levels in these fisheries. The state also obtained management control of black and dusky rockfish fisheries in federal waters adjacent to the North Gulf of Alaska from the NPFMC in 1997.

Currently, the Gulf of Alaska Fishery Management Plan of the NPFMC does not address recreational fisheries. This leads to the potential of a boundary effect, where anglers could report that they harvested their rockfish in federal waters where no regulations exist. Given the absence of recreational fisheries in this plan, the state is considering extending its authority over recreational rockfish fisheries into the waters of the EEZ. The ABOF is scheduled to discuss this at their February 1998 meeting.

If these measures are not sufficient to protect nearshore rockfish and stock declines occur, it may be necessary to adopt an even more restrictive management strategy. One strategy being

considered is to set aside rockfish refuges where no harvest of rockfish is allowed. This strategy has been suggested by several managers in the literature and is currently being employed in California. However, implementation of this strategy would significantly reduce fishing opportunity for other species and therefore must be carefully considered prior to implementation. Some refuges already exist through exclusion zones around documented marine mammal haulouts. The effectiveness of these refuges should be evaluated in the future. A white paper discussing the merits and drawbacks of refuges is presented in Vincent-Lang 1995a.

Concern has also been raised that commercial rockfish harvests may increase as a result of a new Individual Fishery Quota (IFQ) system enacted for the Alaskan commercial halibut fishery during 1995. Under the new IFQ system, commercial halibut fishermen have up to 8 months to catch their annual individual halibut quota. Under the old system, commercial halibut fishermen had, at maximum, up to two 24-hour periods to catch an area quota. This resulted in an incentive to fish clean, as bycatch during severely time-restricted openings resulted in reduced landing of halibut. Because bycatch in nearly all cases is lower in value than halibut, it resulted in a reduced value of the landing. There is a fear under the new system that because time is not limited, bycatch will increase. For fishes with high exploitable biomasses, this is not viewed as a problem. However, for fishes such as rockfish that have very low exploitable biomasses, increased bycatch may result in overharvest. Department managers are considering asking the ABOF for permission to close areas in which rockfish quotas have been achieved to commercial longline fishing to avoid further rockfish bycatch. Data to address this question have not been analyzed to date. Observations during the first several seasons of IFQ fishing suggest that some increase in harvest of nontarget species has occurred. A recent legal opinion to the ABOF grants the department the authority to close halibut fisheries in state waters if a stock conservation problem for a state-managed species can be demonstrated.

Concern has also been raised that an IFQ system will result in increased competition on the fishing grounds between commercial fishermen and sport anglers. Competition was minimal in the past because the commercial fishery operated far offshore where the abundance of large halibut was higher during spring and fall commercial openings. The long season permissible under the IFQ system will allow overlap of commercial and sport fishing times. In addition, the commercial fleet will likely fish close to port. Implementation of an IFQ system in Canada resulted in a significant number of vessels fishing closer to port, despite lower catch rates. Data to address this question have not been analyzed to date. However, these concerns have caused some recreational fishing groups to discuss establishment of exclusion zones for the commercial fishery that encompass their traditional fishing areas near major sport ports. As can be expected, such proposals have not been well received by commercial fishermen. A measure to develop local area management for halibut may help resolve these concerns.

Management History

Prior to 1973, the recreational fishery for rockfish along the North Gulf of Alaska was unregulated. In 1973, the ABOF adopted a 10 daily and 10 in possession limit for rockfish harvested in the Cook Inlet-Resurrection Bay Saltwater Area. In 1989, the ABOF reduced the daily bag limit for this area to 5, the possession limit did not change. This action was taken to reduce harvest given staff concern for the health of the resource in this regulatory area. Also in 1989, the ABOF adopted a 20 fish daily/20 fish possession limit for rockfish in the Prince William Sound Regulatory Area, of which no more than 5 rockfish could be red rockfish. This

action was taken in recognition of rockfish as a sport species requiring management. The special requirement for red rockfish was enacted given staff concern for overharvest of these longer-lived rockfish (e.g., yelloweyes).

In 1991, the ABOF reduced the limits in the Prince William Sound Regulatory Area using a seasonal approach, given staff concern for rockfish stocks in this regulatory area. During the summer months (May 1-September 15), the ABOF reduced the limits for rockfish in this regulatory area to 5 per day, 10 in possession from May through September 15, and 10 per day and in possession from September 16 through April 30. Additionally, the ABOF mandated that all rockfish which are removed from the water in this area must be retained as part of the bag limit of the person originally hooking them. These actions were taken in an attempt to assure harvests would remain sustainable. The ABOF also removed the stipulation that only 5 may be red rockfish. This later action was taken over concern that many black rockfish were being released to harvest red rockfish and that many of the released black rockfish were suffering high mortality. In 1993, the ABOF adopted a 10 fish daily bag limit and 20 fish possession limit for rockfish in the Kodiak Regulatory Area. In 1994, the ABOF adopted a 10 fish daily bag limit and 20 fish possession limit for rockfish in the Alaska Peninsula-Aleutian Islands Regulatory Area. These last two actions were taken in recognition of rockfish as a sport species requiring management in these regulatory areas.

In 1995, the ABOF adopted a new bag and possession limit for rockfish in the Cook Inlet-Resurrection Bay Saltwater Area. The new regulation: 5 rockfish daily, 10 in possession of which not more than 2 daily, 4 in possession may be nonpelagic rockfish, was taken to address conservation concern issues for pelagic shelf rockfish. In 1996, the ABOF adopted a regulation specifying that no more than 2 rockfish daily and 4 in possession may be nonpelagic rockfish in the waters of Prince William Sound.

Ongoing Research and Management Activities

A research program to evaluate rockfish stocks in the North Gulf of Alaska is currently underway. The objectives of this program are to collect age, sex, and length composition data and to obtain species composition statistics for the sport harvest of rockfish in this area. In addition, the distribution of recreational groundfishing effort and harvest is being monitored. Ports currently being sampled include Valdez and Seward in the North Gulf of Alaska and Kodiak and Homer. In 1997 the Division of Sport Fish initiated research aimed at assessment of stock structure and status of nearshore black rockfish populations near Seward. This is envisioned to be a multi-year project. Initial efforts are focussed on developing study methodologies and assessing stock structure and migration. In combination, these data are being used to determine selected life history characteristics of the commonly harvested rockfish species and to evaluate stock status and validity of current management strategies. Staff recommend continuation of the current research program. Additionally, staff recommend that an aging validation study for rockfish be implemented to determine the validity of and magnitude of errors associated with current aging practices.

The Division of Sport Fish is instituting a logbook reporting system for all charters operating in marine waters off Alaska in 1998. Data to be collected with this program include catch figures, locations of catch, number of clients, residence information of clients, ownership of vessels, and identity of operators. No proprietary information about clients will be collected. Information

collected as part of this program should be useful to aid decisions regarding management and allocation of North Gulf of Alaska rockfish resources.

NORTH GULF OF ALASKA RECREATIONAL LINGCOD FISHERY

Lingcod belong to the Hexagrammids, a family of fish unique to the west coast of North America. These fish, which are actually greenlings and not true cods, are predatory and can grow to over 22 kg (50 pounds) and 122 cm (4 ft). Their distribution extends from the Alaska Peninsula/Aleutian Islands south to Baja California. In the North Gulf of Alaska, they are common from Cape Suckling eastward to Cape Trinity on the southern end of Kodiak Island.

Beginning in the mid-1980s, this species became a popular target of recreational anglers fishing North Gulf of Alaska waters, specifically those waters accessible from Seward (Table 13, Figure 17). The recreational fishery for lingcod in the North Gulf of Alaska occurs in state and adjacent federal waters. In these waters, responsibility for management and allocation of lingcod lies with the ABOF¹. In response to increasing harvests and concern expressed regarding the health of the North Gulf of Alaska lingcod resource, the ABOF adopted new regulations for North Gulf of Alaska recreational lingcod fisheries during 1993. Vincent-Lang and Bechtol (1992) summarize the actions taken by the ABOF to manage these stocks for sustained yield and the rationale the ABOF used towards taking these actions. The current regulations governing recreational lingcod fisheries in the North Gulf of Alaska are:

- ✓ Resurrection Bay, enclosed from a line extending from Cape Aialik to Cape Resurrection, is closed to the commercial and recreational harvest of lingcod. All lingcod caught in these waters must be released immediately.
- ✓ The bag and possession limit for sport-caught lingcod in the area between Cape Puget and Gore Point is 1. The bag and possession limits for all other waters of the North Gulf of Alaska are 2 and 4, respectively.
- ✓ In all North Gulf of Alaska regulatory areas lingcod may only be taken from July 1 through December 31.
- ✓ Only lingcod 35 inches or more in total length or 28 inches or more with their head off may be retained in the Prince William Sound and Cook Inlet-Resurrection Bay Saltwater regulatory areas. There are currently no size limits for lingcod in the Kodiak or Alaska Peninsula-Aleutian Islands regulatory areas.
- ✓ All sport-caught lingcod in the Prince William Sound, Cook Inlet-Resurrection Bay Saltwater, and Kodiak regulatory areas may be landed only by hand or net.

A commercial fishery for lingcod also occurs in the North Gulf of Alaska (Table 14). In all years since 1991, commercial lingcod landings have been lower than recreational lingcod landings along the North Gulf of Alaska (Table 15). In state and adjacent federal waters, the ABOF has allocative and management responsibility for lingcod¹. Until 1993, the Commercial Fisheries Management and Development Division lacked specific strategies for the management of lingcod in state waters, and the commercial harvest of this species was largely unmanaged. In 1993, the

¹ In 1995, the state extended its regulatory authority into federal waters of the EEZ off Alaska through an emergency regulation. This was done given the absence of lingcod in the federal Gulf of Alaska Fishery Management Plan. Both commercial and sport regulatory authority were extended.

ABOF adopted several regulations governing the commercial harvest of lingcod in the north Gulf of Alaska. These regulations impose minimum size limits, season and area closures, and trip and bycatch limits to help rebuild depressed stocks and assure the sustained yield of healthy stocks.

Table 13.-Harvest of lingcod, by area, by recreational anglers fishing North Gulf of Alaska waters, 1987-1996.

Year	Prince William Sound	North Gulf Coast (Cape Puget-Gore Point)	Kodiak	Alaska Peninsula Aleutian Islands	Cook Inlet	Total
1987		2,142				
1988		4,189				
1989		5,505				
1990		6,955				
1991	1,979	6,126	1,352	993	2,841	13,291
1992	2,575	8,081	1,454	299	3,199	15,701
1993	2,008	3,079	922	198	1,681	7,888
1994	1,658	3,712	1,014	185	1,240	7,809
1995	2,316	2,619	932	75	1,147	7,089
1996	1,665	2,271	832	0	1,023	5,791

Management Objective and Approach

Management of North Gulf of Alaska lingcod stocks is directed towards assuring the sustained yield of the various lingcod stocks that occur within the area, while assuring continued and, where possible, expanded opportunity to participate in diverse fisheries targeting these stocks.

In the marine waters of the North Gulf of Alaska, insufficient data are currently available to estimate exploitable biomass. No research is currently being conducted, or planned, to collect these data in the near-term future. Thus, recreational lingcod fisheries in the North Gulf of Alaska are managed using a conservative approach aimed at assuring optimal sustained yield. Given that lingcod recruitment has been shown to be highly variable, the current management approach is to assure that sufficient fish are present in the spawning population for future recruitment. This is done in three ways: (1) protect spawning and nest guarding fish—the sport and commercial season is closed from January 1 through June 30; (2) allow fish to spawn at least once before being subject to harvest—a 35-inch minimum size limit for both sport and commercial fisheries; and (3) restrictive catch limits—the sport fishery is currently restricted to a 2 fish daily, 4 fish in possession limit in areas of healthy stock status, in areas of less healthy stock status, the daily bag and possession limit is reduced. The commercial fishery is restricted by closed waters and seasons, minimum size restrictions, and bycatch quotas.

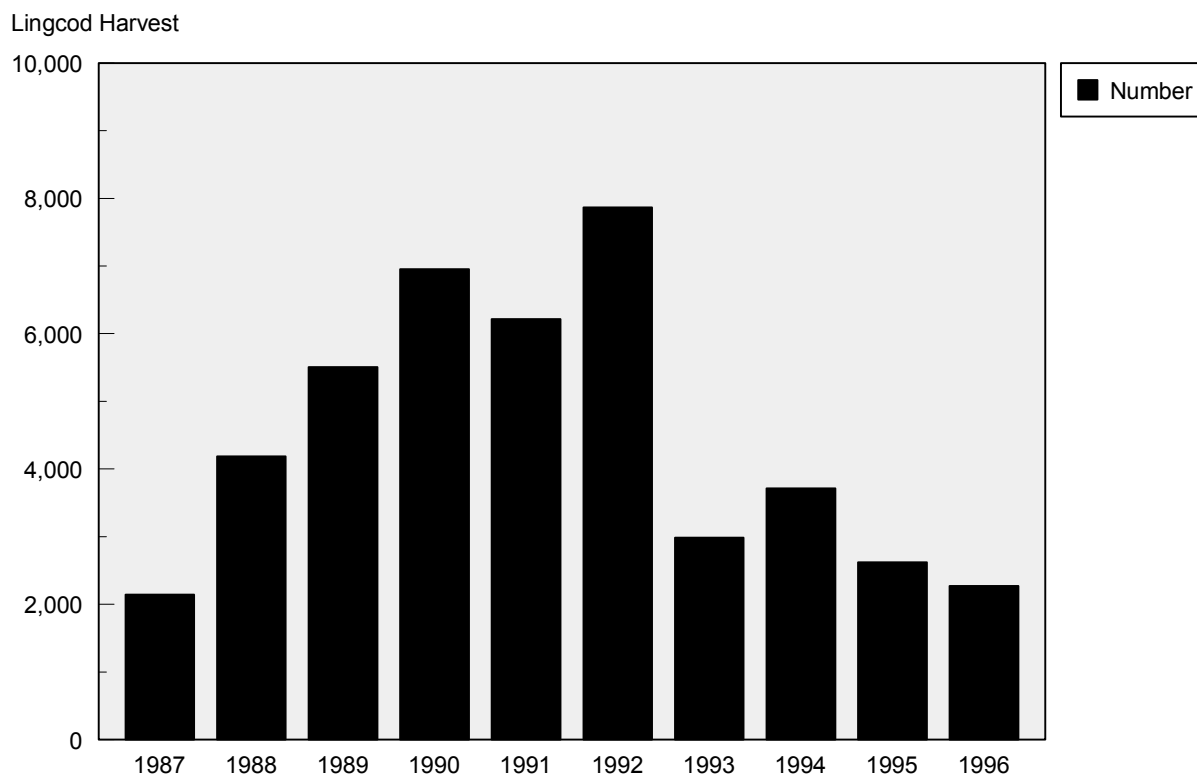


Figure 17.-Harvest of lingcod by recreational anglers fishing Seward area waters, 1987-1996.

Table 14.-Commercial harvest (pounds, round weight) of lingcod, by area, along the North Gulf of Alaska, 1987-1996.

Year	Prince William	North Gulf Coast	Total
	Sound	Cook Inlet	
1987	29,963	27,976	57,939
1988	24,656	22,668	47,324
1989	4,707	2,718	7,425
1990	4,922	2,932	7,854
1991	65,213	63,222	128,435
1992	43,849	41,857	85,706
1993	89,063	87,070	176,133
1994	58,816	56,822	115,638
1995	77,851	75,856	153,102
1996	61,287	59,291	120,578

Table 15.-Comparison of recreational and commercial harvests of lingcod from North Gulf of Alaska waters, 1991-1996.

Year	Recreational		Commercial ^a		Total
	Number	Percent	Number	Percent	
1991	10,946	72%	4,281	28%	15,227
1992	13,448	82%	2,857	18%	16,305
1993	6,768	54%	5,871	46%	12,639
1994	6,610	63%	3,855	37%	10,465
1995	6,082	54%	5,124	46%	11,206
1996	4,959	55%	4,019	45%	8,978

Note: Waters include Prince William Sound, North Gulf Coast, and Cook Inlet, including adjacent federal waters.

^a Based on a 30-pound average weight (round).

Stock Status

Most lingcod stocks in the North Gulf of Alaska are currently healthy. However, stocks in and near to Resurrection Bay are currently depressed. To rebuild severely depressed stocks in Resurrection Bay, the sport and commercial fishery inside Resurrection Bay is currently closed. Catch rate and size information collected during the summer of 1993 during fishery-independent sampling indicate that these stocks remain severely depressed and recruitment has yet to occur. Based on this, these waters will remain closed as currently regulated. To rebuild depressed stocks outside Resurrection Bay, the daily bag limit and possession limit has been reduced to 1 from Cape Puget to Gore Point.

Fishery Overview

A complete history of the recreational and commercial fisheries for lingcod in the north Gulf of Alaska through 1992 is provided in Vincent-Lang and Bechtol (1992), Meyer (1993b), and Hepler et al. (1993).

Since the adoption of the new regulations for lingcod in 1993, both recreational and commercial harvests of lingcod have dropped. Recreational harvest along the North Gulf of Alaska dropped annually since 1991, dropping to 5,800 during 1996 (Table 13). Recreational lingcod harvests near Seward (North Gulf Coast), where the most restrictive regulations were enacted to protect and rebuild depressed stocks, dropped the most, decreasing by 72% between 1992 and 1996 (Table 13, Figure 17). This drop was on target with the goal of reducing the recreational harvest by half through the adoption of the new regulations. It appears that recreational anglers are releasing a high percentage of their catch (Table 16, Figure 18). Mortality of released lingcod is considered to be low (likely less than 5%). Commercial harvests have stabilized at about 130,000 pounds or 4,300 fish (Table 15).

Table 16.-Percent of lingcod catch, by area, that was released by recreational anglers fishing North Gulf of Alaska waters, 1991-1996.

Year	Prince William Sound	North Gulf Coast	Kodiak	Alaska Peninsula Aleutian Islands	Cook Inlet	Total
1991	45	16	34	55	61	41
1992	70	29	53	90	77	62
1993	71	57	62	74	80	69
1994	63	70	69	61	87	69
1995	56	52	40	87	80	62
1996	68	47	38	100	84	66

Percent Released

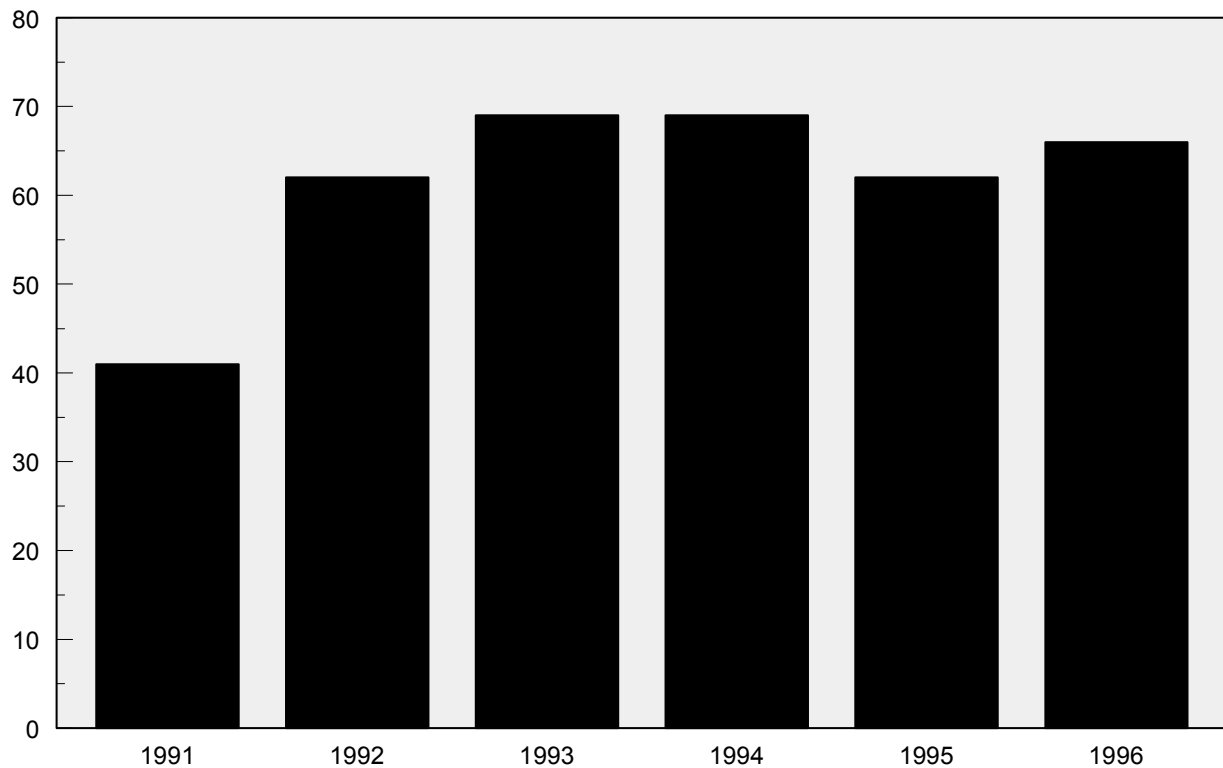


Figure 18.-Percent of lingcod caught by recreational anglers fishing North Gulf of Alaska waters that were released, 1991-1996.

Management Issues

Catch rate information from the fishery-independent sampling indicates that the abundance of lingcod within Resurrection Bay remains extremely low; thus, these waters will remain closed to the commercial and recreational harvest of lingcod. Length data collected during the fishery-independent sampling (Vincent-Lang 1995b) indicate that recruitment has yet to occur in Seward area lingcod populations outside Resurrection Bay (Figure 19); thus, the reduced bag and possession limits will remain in effect for these waters. No sampling was conducted during 1995 due to budget constraints. However, the sampling will be conducted again during the summer of 1998. If recruitment does not occur in these stocks, proposals will be submitted to the ABOF to further restrict or close the recreational and commercial lingcod fisheries in the Chiswell Island area.

Concern has also been raised that commercial lingcod harvests may increase as a result of a new Individual Fishery Quota (IFQ) system enacted for the Alaskan commercial halibut fishery during 1995. Under the new IFQ system, commercial halibut fishermen have up to 8 months to catch their annual individual halibut quota. Under the old system, commercial halibut fishermen had, at maximum, up to two 24-hour periods to catch an area quota. This resulted in an incentive to fish clean, as bycatch during severely time-restricted openings resulted in reduced landing of halibut. Because bycatch in nearly all cases is lower in value than halibut, it resulted in a reduced value of the landing. There is a fear under the new system that because time is not limited, bycatch will increase. For fishes with high exploitable biomasses, this is not viewed as a problem. However, for fish such as lingcod that have identified stock conservation issues and resultant low exploitable biomasses, increased bycatch may result in overharvest. Data from 1995 suggest that commercial harvest has in fact increased and that much of this increase is due to bycatch.

Concern has also been raised that an IFQ system will result in increased competition on the fishing grounds between commercial fishermen and sport anglers. Competition was minimal in the past because the commercial fishery operated far offshore where the abundance of large halibut was higher during spring and fall commercial openings. The long season permissible under the IFQ system will allow overlap of commercial and sport fishing times. In addition, the commercial fleet will likely fish close to port. Implementation of an IFQ system in Canada resulted in a significant number of vessels fishing closer to port, despite lower catch rates. Data to address this question have not been analyzed to date. These concerns have caused some recreational fishing groups to discuss establishment of exclusion zones for the commercial fishery that encompass their traditional fishing areas near major sport ports. As can be expected, such proposals have not been well received by commercial fishermen. A measure to develop local area management for halibut may help resolve these concerns.

Management History

Prior to 1987, recreational fisheries for lingcod were unregulated in the North Gulf of Alaska. In 1987, the ABOF adopted a 2 fish daily, 4 fish possession limit for the Cook Inlet-Resurrection Bay Saltwater Regulatory Area to reduce harvest, given staff concern that local stocks near Resurrection Bay were being overharvested. In 1991, the ABOF adopted a 2 fish daily, 4 fish possession limit for the Prince William Sound Regulatory Area. In 1993, the ABOF revamped the lingcod regulations for the North Gulf of Alaska. Effective for the 1993 season, the ABOF adopted the following regulations:

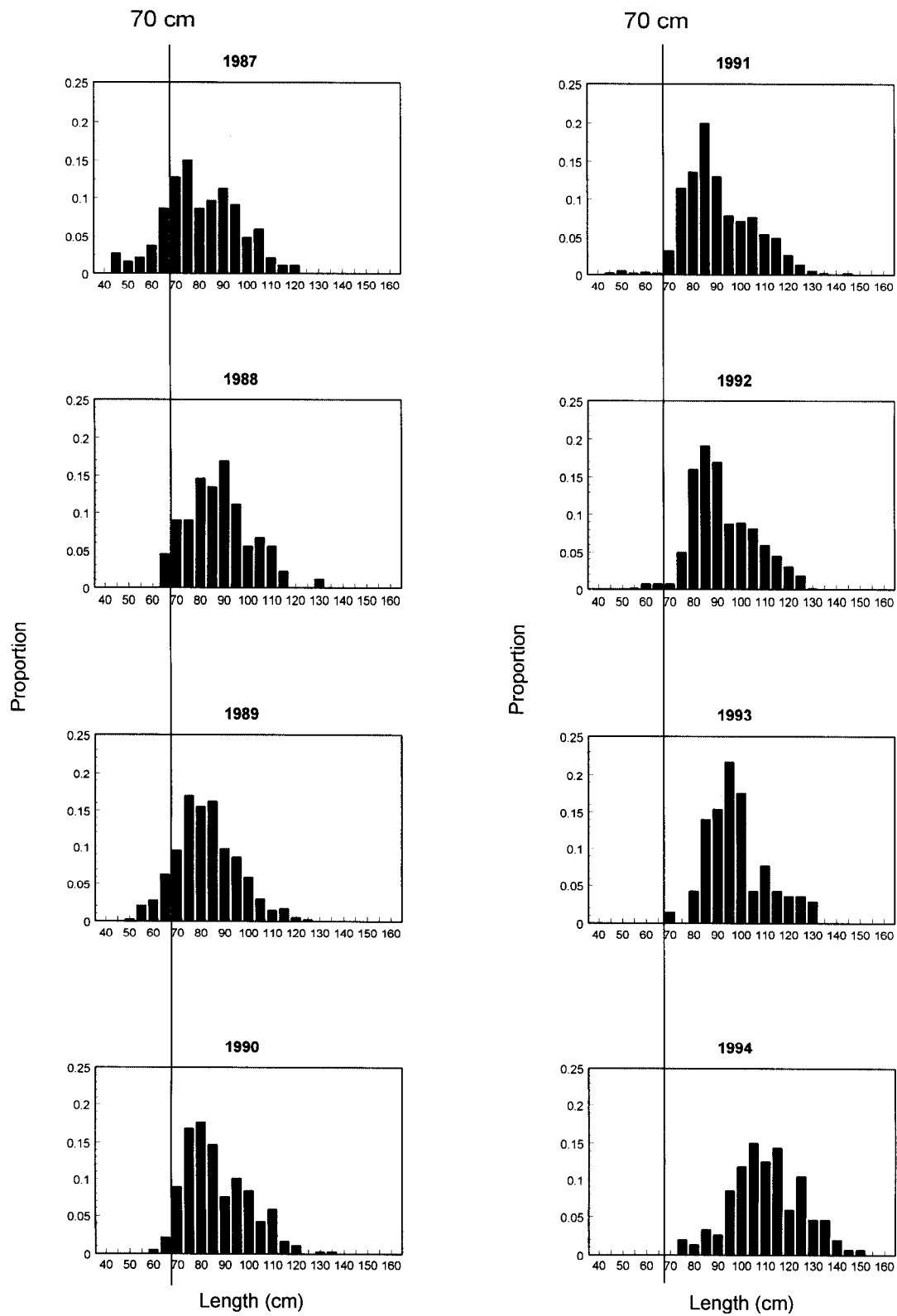


Figure 19.-Length frequencies of lingcod sampled near Seward, 1987-1994.

- ✓ Resurrection Bay, enclosed from a line extending from Cape Aialik to Cape Resurrection, is closed to the commercial and recreational harvest of lingcod. All lingcod caught in these waters must be released immediately. This regulation was put in place in 1993 to protect and help rebuild severely depressed lingcod stocks in these waters.
- ✓ The bag and possession limit for sport-caught lingcod in the area between Cape Puget and Gore Point is 1. This regulation was put in place in 1993 to protect and help rebuild depressed lingcod stocks in these waters.
- ✓ In all North Gulf of Alaska regulatory areas except the Alaska Peninsula-Aleutian Islands regulatory area, lingcod may only be retained from July 1 through December 31. The closed period was put in effect in 1993 to protect spawning and nest-guarding lingcod.
- ✓ Only lingcod 35 inches or more in total length or 28 inches or more with their head off may be retained in the Prince William Sound and Cook Inlet-Resurrection Bay Saltwater regulatory areas. This regulation was established in 1993 to assure lingcod could spawn at least once prior to being subject to harvest.
- ✓ All lingcod sport-caught in the Prince William Sound, Cook Inlet-Resurrection Bay Saltwater, and Kodiak regulatory areas may be landed only by hand or net. This regulation was put in place in 1993 to increase the survival of released lingcod.

In 1994, the ABOF adopted a closed season (January 1 through June 30) and daily bag (2) and possession (4) limit for lingcod in the Alaska Peninsula-Aleutian Islands area. In 1995, the state extended its regulatory authority into federal waters of the EEZ off Alaska through an emergency regulation. Both commercial and sport regulatory authority were extended. This was possible given lingcod were not covered under a federal fishery management plan.

Ongoing Research and Management Activities

A research program aimed at estimating the age, sex, and length compositions of the recreational lingcod harvests from Central Gulf of Alaska waters has been annually conducted since 1987. Healthy stocks are being monitored through this port sampling program to evaluate trends in age and size compositions. Depressed stocks in and near Resurrection Bay are being monitored to evaluate their recovery. Recovery of stocks is being evaluated periodically through collection of fishery-independent age and size statistics to evaluate time-series trends in recruitment. These surveys will be conducted in 1998. With the implementation of minimum size limits, the ability to assess recruitment to these stocks via sport harvest monitoring was lost. It is recommended that these two research efforts continue.

The Division of Sport Fish is instituting a logbook reporting system for all charters operating in marine waters off Alaska in 1998. Data to be collected with this program include catch figures, locations of catch, number of clients, residence information of clients, ownership of vessels, and identity of operators. No proprietary information about clients will be collected. Information collected as part of this program should be useful to aid decisions regarding management and allocation of North Gulf of Alaska lingcod resources.

NORTH GULF OF ALASKA RECREATIONAL SALMON SHARK FISHERY

The salmon shark *Lamna ditropis* is a member of the shark family Lamnidae. As a group, these sharks are commonly referred to as mackerel sharks, because they feed on pelagic species such as mackerel or salmon. Pacific Ocean species include the salmon shark, the white shark *Carcharodon carcharias*, the mako shark *Isurus oxyrinchus*, and the thresher shark *Alopias vulpinus*. The porbeagle shark *Lamna nasus*, commonly mistaken with the salmon shark, is also a member of this family, but is only found in the Atlantic Ocean.

In the Pacific Ocean, salmon sharks are distributed coastwide in the temperate and subarctic waters from Japan to Southern California (Hart 1973). Research suggests that there are at least two major populations in the northern Pacific; one centered in the Kurile Island group off Japan and one in the central Aleutian Islands area (Sano 1959, 1960; Macy et al. 1978). Circumstantial evidence indicates a possible third population in the area southeast of Kodiak Island in the Central Gulf of Alaska (Paust and Smith 1989). To date, no research has been directed towards describing the seasonal migratory patterns of these stocks.

The concept of “principal” and “accessory” populations has been proposed for other species of pelagic shark (Springer 1979; Otwell et al. 1985; Kreuzer and Ahmed 1978). Principal populations are comprised of main breeding populations. Accessory populations are inshore groupings of shark taking advantage of the seasonal abundance of prey. Although speculative, this concept may explain the seasonal nature and frequency of observations of salmon shark in the central Gulf of Alaska. In this area, salmon sharks are commonly sighted along the outer coast of the Kenai Peninsula and in Prince William Sound. They are most frequently observed during summer months concurrent with inshore returns of salmon. Aggregations of salmon shark have been reported in bays with salmon streams at the head and along the coast near known salmon migratory paths. Infrequent observations of sharks during winter months suggest a seasonal migratory pattern associated with availability of prey. This tendency to aggregate during summer months makes the salmon shark particularly vulnerable to harvest in near coastal waters. If accessory populations of salmon shark exist in the Gulf of Alaska, fisheries targeting these populations would rely upon replenishment from principal population(s) to ensure sustainability.

Little is known about the life history of the salmon shark. Fertilization is internal, with birth of fully developed offspring after a lengthy period of gestation. Some believe the salmon shark to be ovoviviporous, i.e. the fertilized egg develops entirely within the uterus without connection to the uterus wall (Castro 1983). Other researchers believe the salmon shark to be viviparous, i.e. the egg is attached to the uterine wall with formation of a pseudo placenta (Makihara 1980; Macy et al. 1978; Okada 1955). The fecundity of salmon sharks is believed to be low in relation to other sharks. Hart (1973) estimates that up to four offspring are produced during a reproductive cycle. It is not known if reproductive cycles occur annually (Paust and Smith 1989). The length of gestation is unknown, however thresher shark from the same family, are believed to have a gestation period of approximately 9 months (Cailliet and Bedford 1983).

The salmon shark is believed to become sexually mature at approximately 6 to 6.5 ft in length (Okuda and Kobayashi 1968; Makihara 1980). Other studies suggest that males mature earlier (5 years) than females (9-10 years, Paust and Smith 1989). Length at maturity for males was 4.6 ft and for females, 5.6 ft. Female salmon shark captured near Seward in 1996 achieved sexual

maturity at a length of 7 ft, but not at a length of 6.5 ft. It is uncertain how long this species can survive, however, they are believed to live beyond 20 years of age (Paust and Smith 1989). Life history characteristics and reproductive strategies of salmon shark are likely to restrict the elasticity of their response to exploitation.

Salmon sharks commonly grow to a length of 10 ft (Hart 1973), however, lengths in excess of 14 ft have been reported by seiners in Prince William Sound (Paust and Smith 1989). During studies conducted in the eastern Pacific, male salmon shark averaged 6.82 ft in length; females 6.79 ft in length. Weights ranged from 154 to 397 lb and averaged 221 lb (Sano 1960). In other studies, maximum recorded weights were in excess of 661 lb (Macy et al. 1978) with a weight of 265 lb expected for a male 6.7 ft in length (Clemens and Wilby 1961; Okuda and Kobayashi 1968).

There is some question as to how rapidly salmon shark grow. A study conducted by Dr. Sho Tanaka (Tokai University, Shimizu, Shizuoka 424, Japan), suggested that salmon shark grew relatively rapidly, reaching an asymptotic length of 8.2 ft in 16 to 20 years (Paust and Smith 1989). A study by Pratt and Casey (1983) that compared growth rates of short fin mako with porbeagle sharks (a close cousin of the salmon shark), showed that the mako shark grew nearly twice as fast as the porbeagle shark. While the salmon shark and porbeagle are distinctly different species, similarities between the species demonstrates the necessity for additional research to quantify growth rates of salmon sharks.

Much of the uncertainty regarding growth in salmon shark is a result of the uncertainty of the aging techniques applied. Shark lack the calcareous otoliths, bones, scales and other hard structures typically used to determine age, however, the circuli in the vertebral centra appear to be formed annually in some pelagic species (Cailliet et al. 1981, 1983a and 1983b). While other aging techniques are available, this approach appears to offer the best potential for accurately determining age and growth of Lamnidae shark (Paust and Smith 1989). Annual formation of circuli in the vertebral centra of salmon shark requires additional verification (Cailliet 1990).

Management Objective and Approach

To date, salmon shark fisheries in the North Gulf of Alaska have not been actively managed and no specific fishery objectives have been formally established. No regulations currently exist governing either the recreational or commercial harvest of this species. Through default, the assumption of current fisheries management is to assure the sustained yield of the salmon shark stocks that occur within the area while assuring continued and, where possible, expanded opportunity to participate in diverse fisheries targeting these stocks.

Stock Status

Unfortunately, there is a lack of historic data to assess either the sustained yields or current status of North Gulf of Alaska salmon shark stocks. Thus, it is unknown at present whether current harvest levels are sustainable. However, based on known life history characteristics, this species is known to be extremely vulnerable to overfishing.

Fishery Overview

Recreational salmon shark fisheries are a recent development in the central Gulf of Alaska. Currently, there are low levels of participation from the ports of Seward, Cordova and Valdez. Harvest and effort are expected to increase as public awareness and acceptance of salmon shark

as a viable big game fish alternative expands. Future refinement of fishing techniques will increase angler success rates and fuel entrepreneurial interest within the charter industry. Given the lack of information regarding biological composition and stock status, there is the potential for overexploitation in a rapidly growing recreational fishery. In recognition of this, Sport Fish Division recently initiated collection of baseline age, sex and size data at selected ports. Additionally, an agenda change request was submitted to the Board of Fisheries to establish a statewide Recreational Salmon Shark Management Plan with provisions for daily and annual bag and possession limits.

Historically, efforts to develop commercial fisheries targeting salmon shark have been sporadic in Alaska. Although the commercial value of this fish is relatively high, the tendency of salmon shark to aggregate in coastal waters coincidental to inshore returns of salmon has limited local interest and participation. The declining value of salmon has sparked renewed interest in salmon shark as an alternative fishery. With little prospect for increasing salmon values, commercial interest in this species is expected to increase. To illustrate, a limited seine fishery targeting salmon shark took place in Prince William Sound during 1996. This fishery was exploratory in nature and harvested less than 50,000 pounds of product. As a measure of success, participants expressed interest in establishing an ongoing salmon shark fishery. In recognition of the potential for overexploitation in an unregulated fishery, the Commercial Fisheries Management and Development Division recently submitted an agenda change request to the Board of Fisheries seeking to establish permit requirements for commercial harvests of all shark species.

Management Issues

As a group, sharks tend to grow slowly, have extended longevity, are advanced in age when they reach sexual maturity and exhibit low fecundity. These characteristics make many species of shark particularly vulnerable to overfishing (Holden 1974). Although much research is still necessary, salmon sharks are likely to exhibit these same biological characteristics. Because of this, management strategies for this species must remain ultra-conservative while vital information regarding their biology and life history are obtained (Holden 1973). The management implications of these biological tendencies may explain the history of management failure in heavily exploited shark populations worldwide. To avoid this historical pattern of failure and to develop sustainable salmon shark management objectives for recreational and commercial fisheries alike, information regarding the life history, biological composition, migratory behavior and status of stocks in the central Gulf of Alaska is urgently needed.

To safeguard against overexploitation, the department has proposed agenda change requests to the ABOF seeking to establish:

1. A statewide Recreational Salmon Shark Fishery Management Plan containing provisions for daily bag and possession limits and seasonal limits, and
2. Permit requirements and harvest limits for commercial fisheries.

The ABOF has accepted these requests and has scheduled discussion for February 1998.

Management History

No regulations currently exist governing either the recreational or commercial harvest of this species.

Ongoing Research and Management Activities

The Division of Sport Fish is proposing instituting a voluntary tag and recovery program at the ports of Seward, Valdez and Cordova. Volunteer fishermen will capture, tag and release salmon sharks. Information for this program may be useful to help characterize migration patterns and stock composition of salmon sharks in the North Gulf of Alaska.

The Division of Sport Fish is instituting a logbook reporting system for all charters operating in marine waters off Alaska in 1998. Data to be collected with this program include catch figures, locations of catch, number of clients, residence information of clients, ownership of vessels, and identity of operators. No proprietary information about clients will be collected. Information collected as part of this program should be useful to aid decisions regarding management and allocation of North Gulf of Alaska salmon shark resources.

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